Plates.
- Drawings of D. H. Burnham & Co.
- Drawings of Cram, Wentworth & Goodhue.
- Drawings of J. A. Schweinfurth.
- Measured Drawing of Colombier d'Ango, by Will S. Aldrich (Rotch Scholar).

THE BRICKBVILDER

DEVOTED TO THE INTERESTS OF ARCHITECTVRE IN MATERIALS OF CLAY

PUBLISHED MONTHLY.
85 WATER STREET, BOSTON, MASS.

VOLVME FIVE

NOVEMBER MDCCCXCVI

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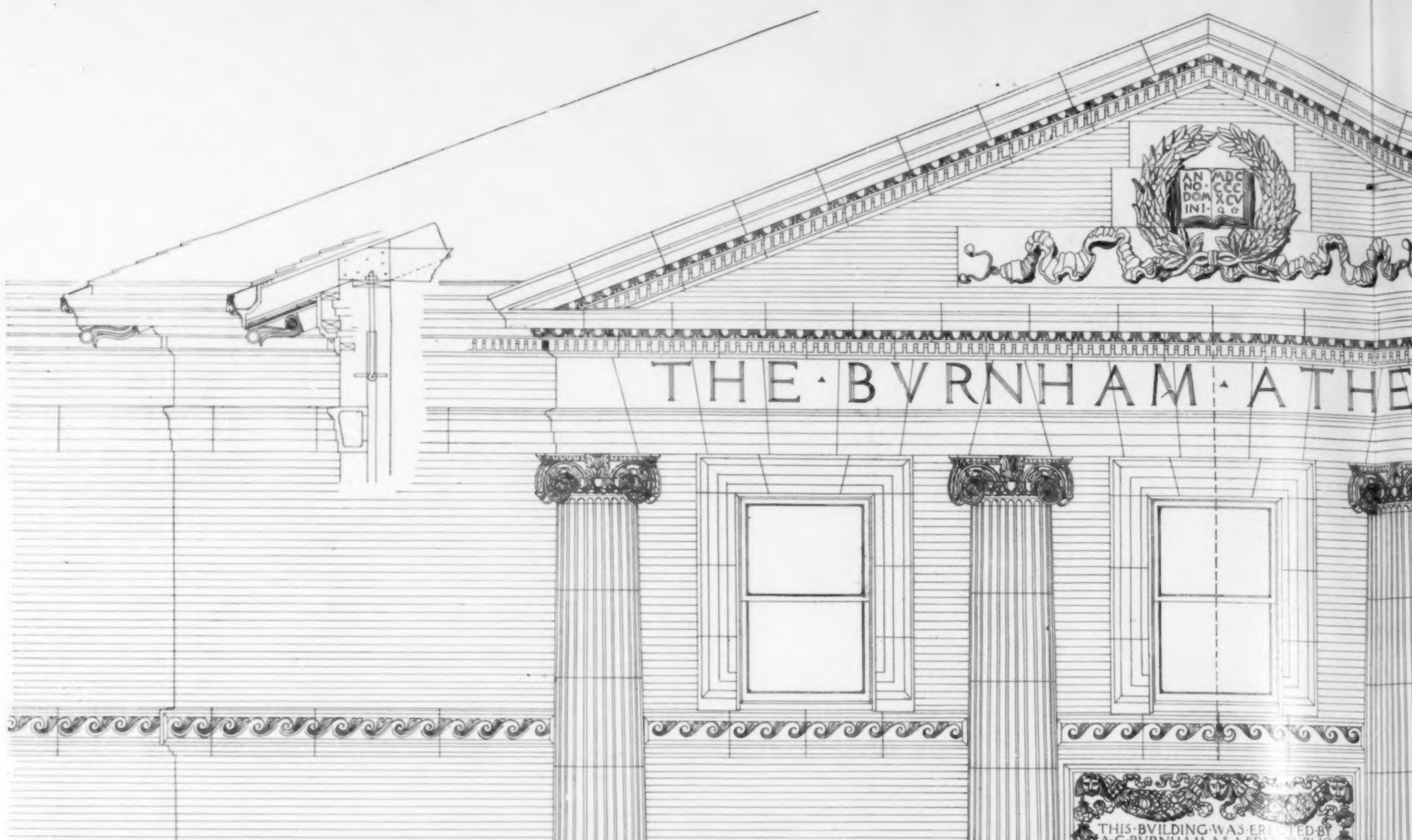
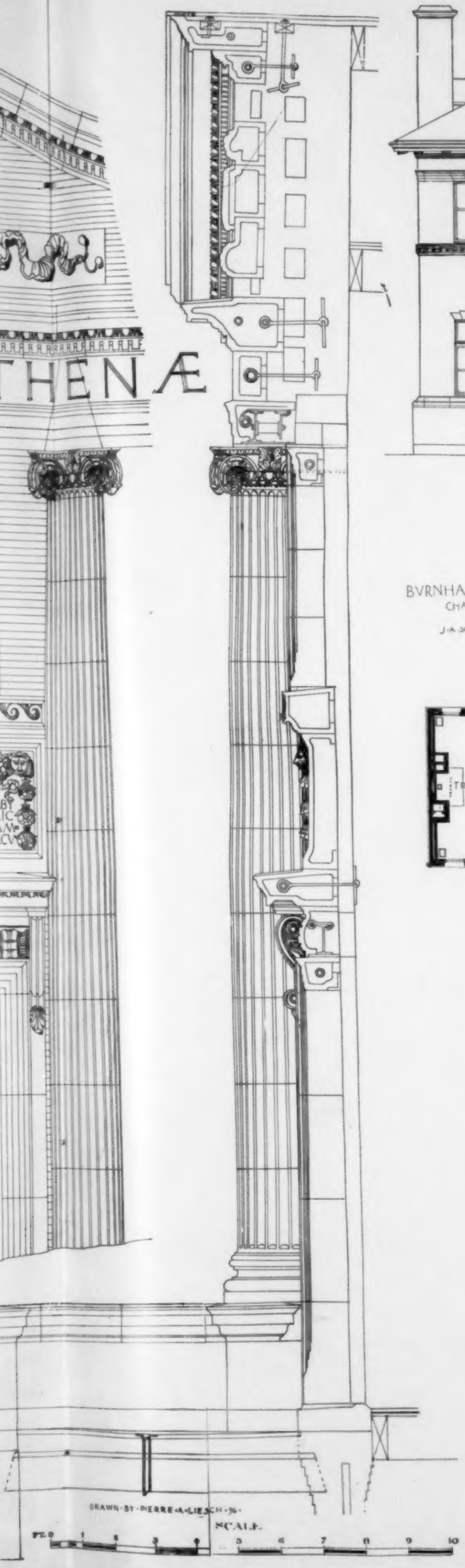


THE BURNHAM ATHENÆ

J. A. SCHWEINFU



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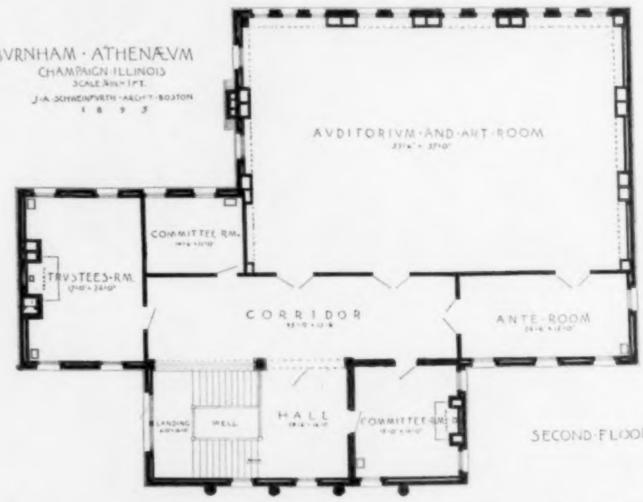

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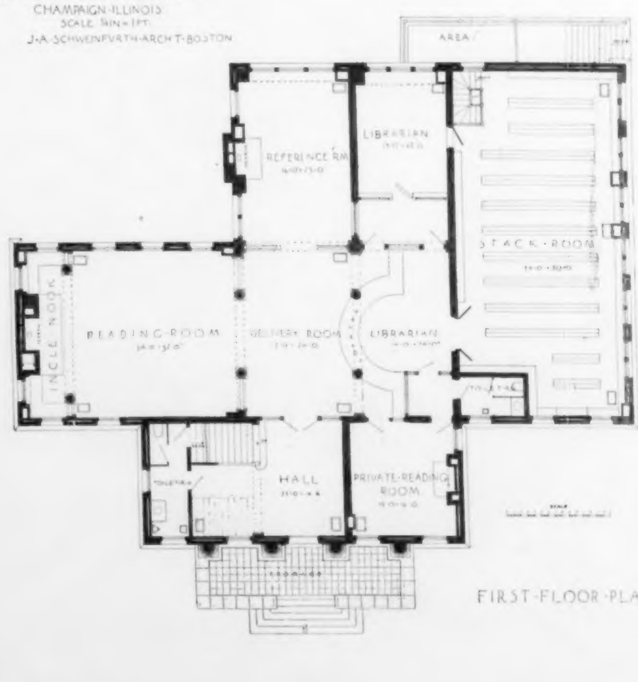

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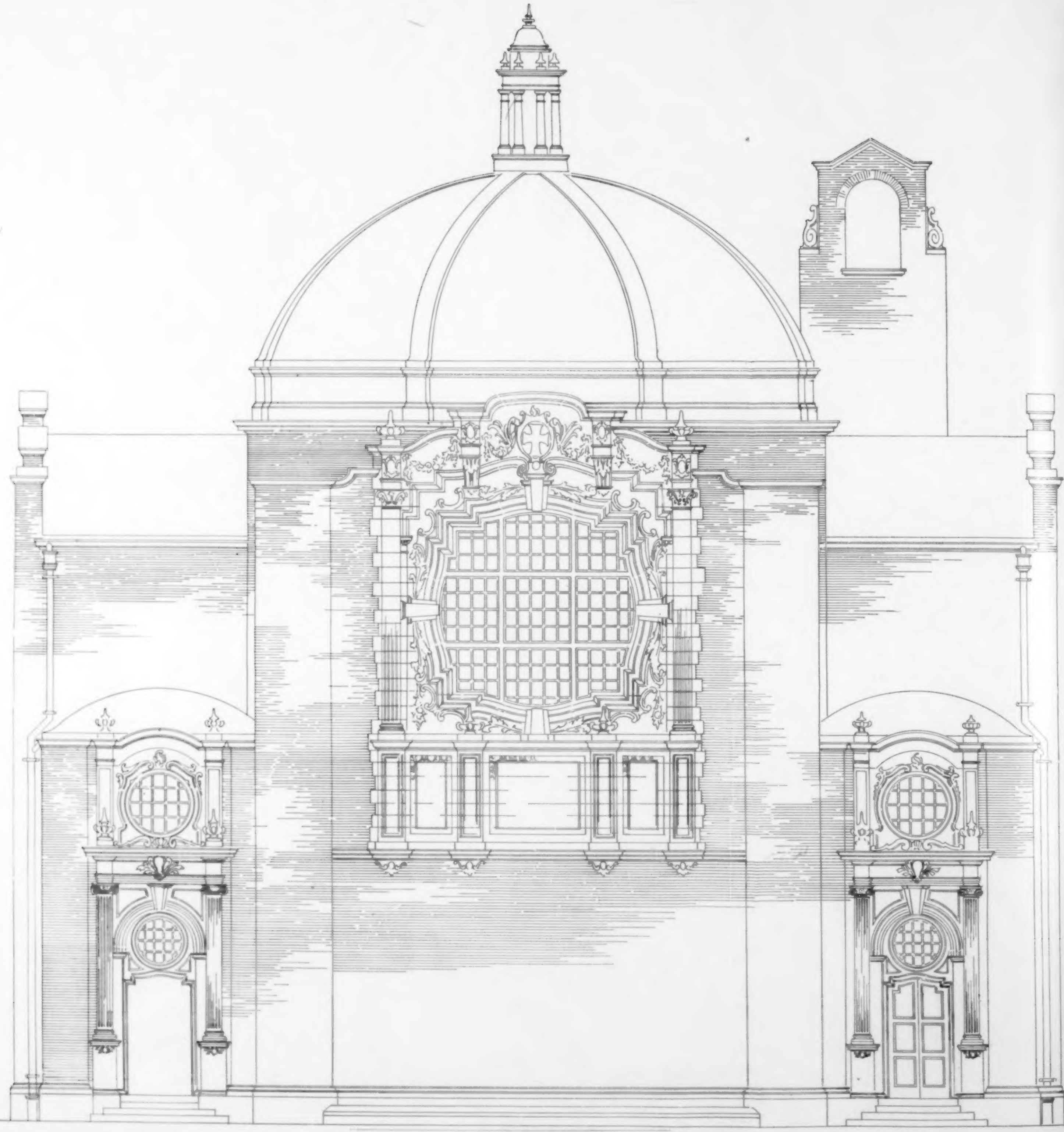

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CRAM, WENTWORTH & GOODH

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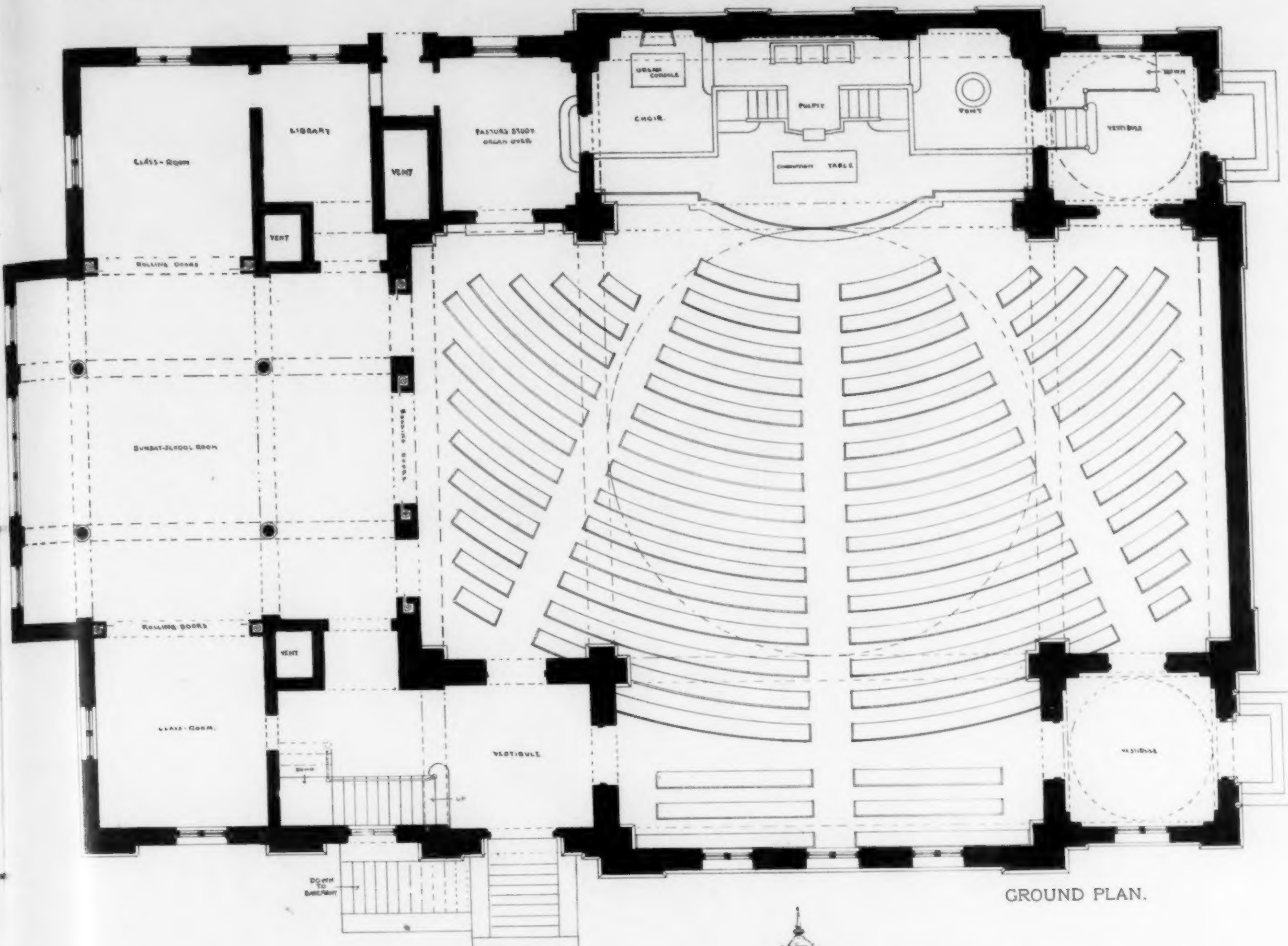

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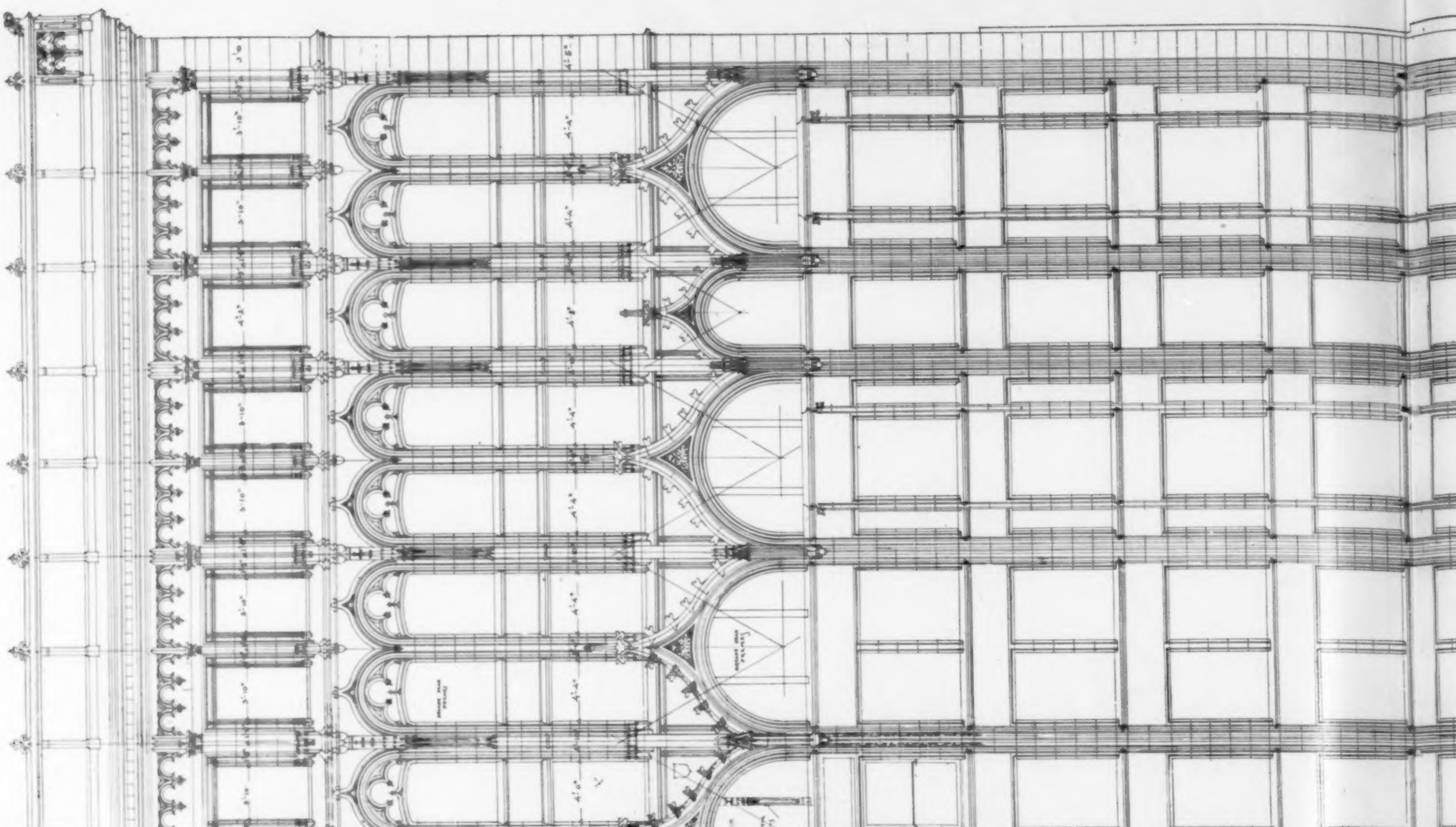
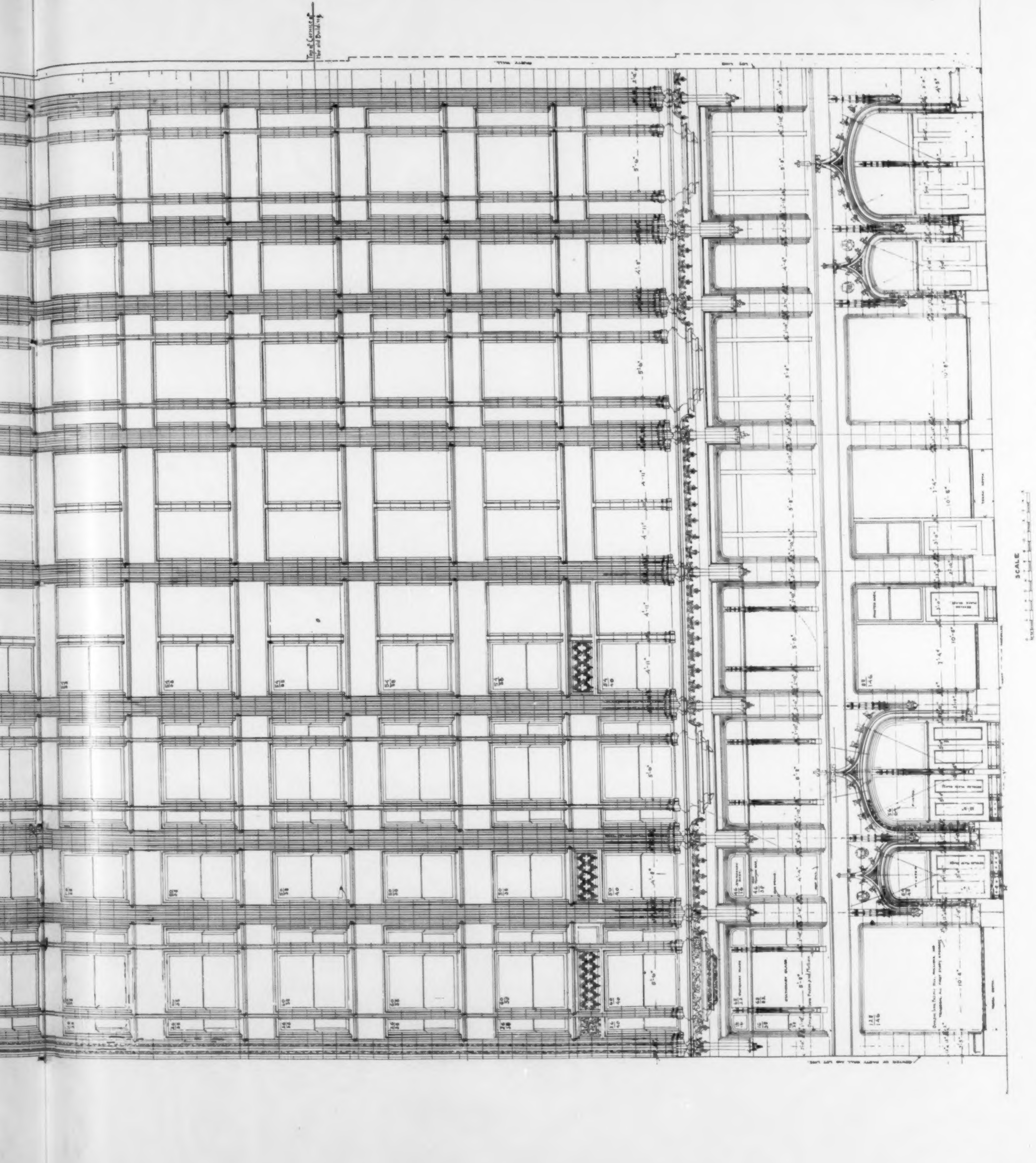
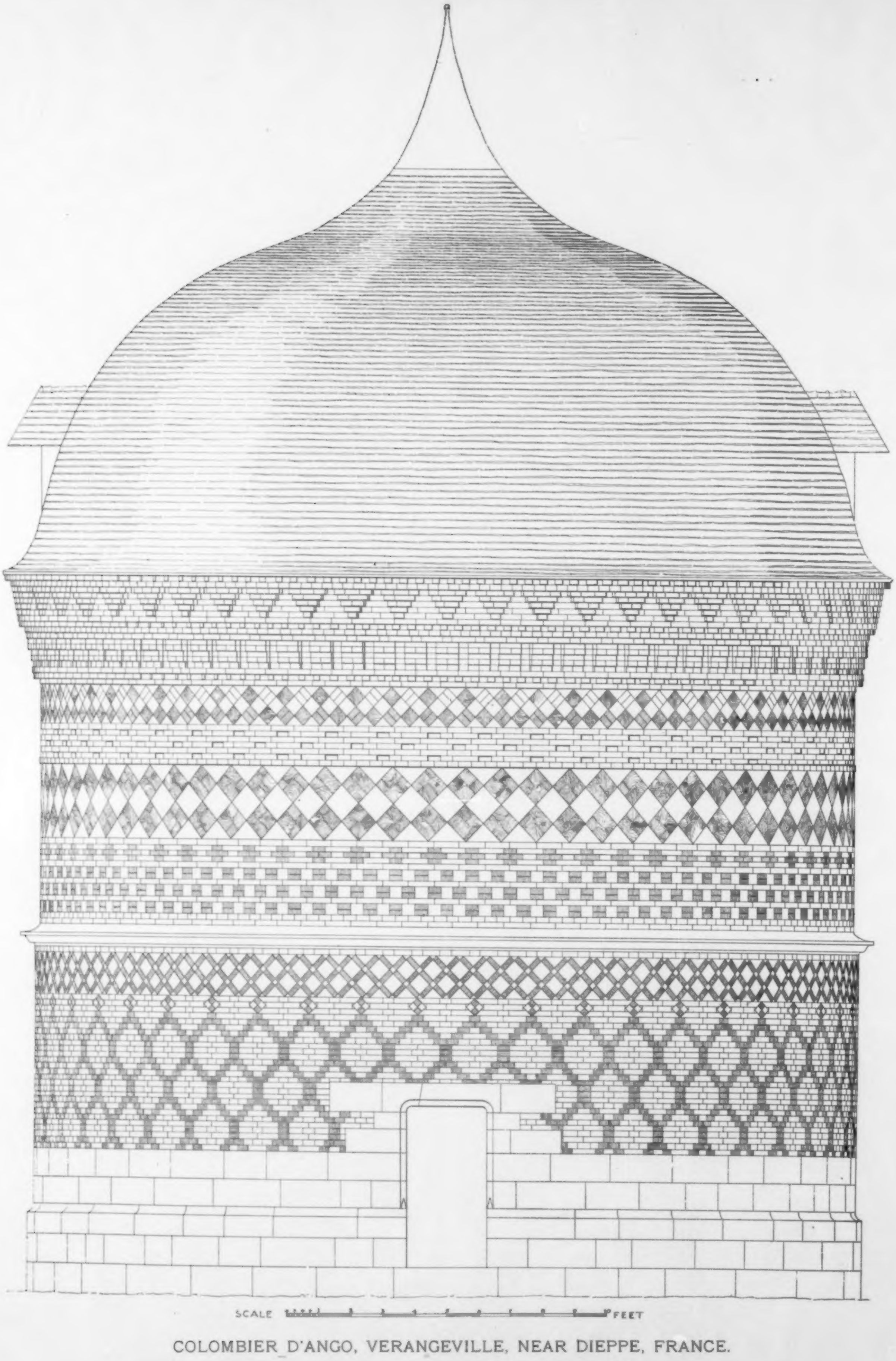




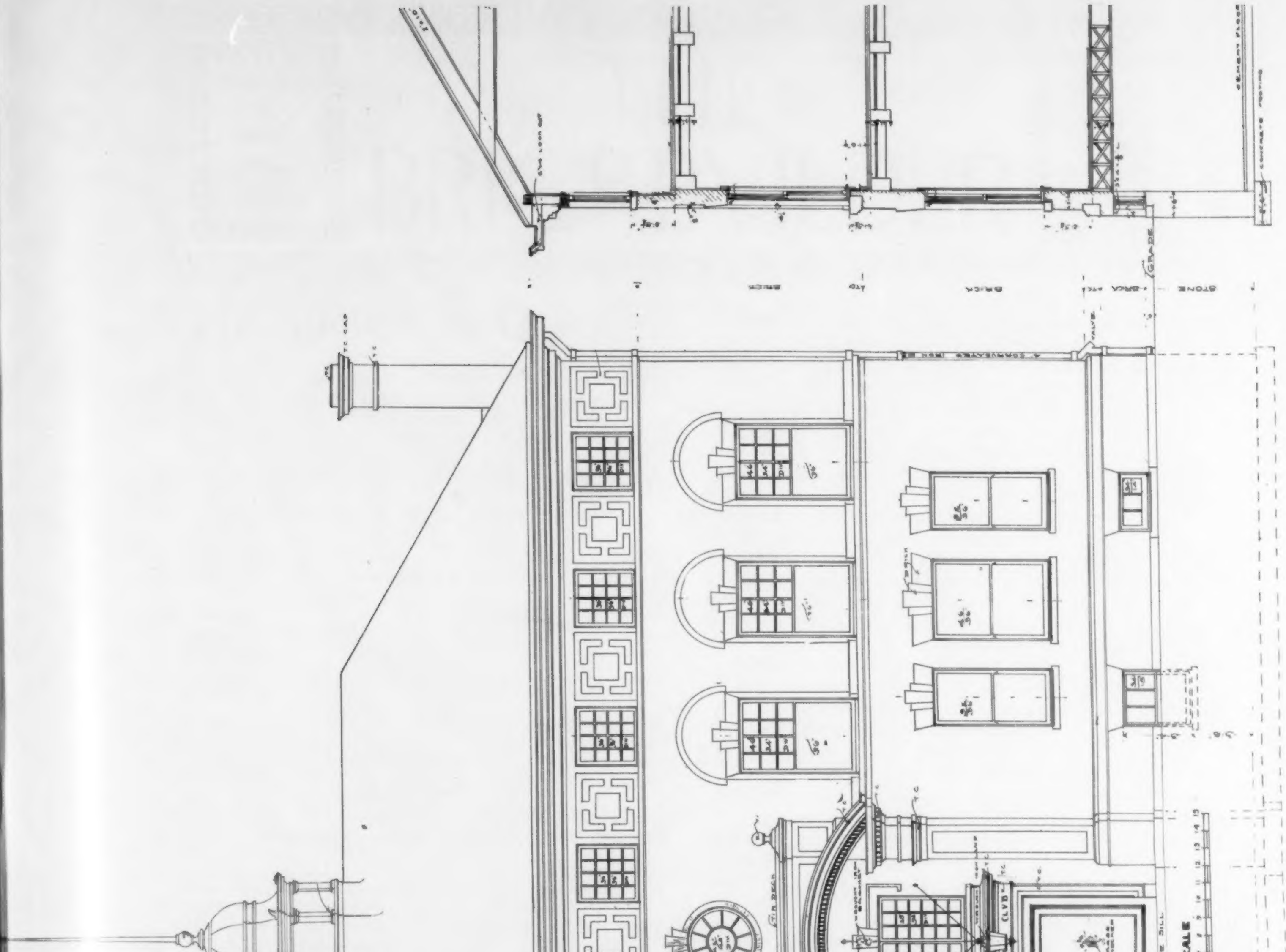
GREAT NORTHERN HOTEL, CHICAGO.—JACKSON STREET ELEVATION.

D. H. BURNHAM & CO., ARCHITECTS.



COLOMBIER D'ANGO, VERANGEVILLE, NEAR DIEPPE, FRANCE.

MEASURED AND DRAWN BY WILL S. ALDRICH (ROTCH SCHOLAR).



BUILDING FOR THE QUADRANGLE CLUB, CHICAGO. FRONT ELEVATION.

D. H. BURNHAM & CO., ARCHITECTS.

VOLVME V NOV. 1896 No. 11

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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AN article by Mr. Cusack, in the last number of THE BRICKBUILDER, emphasizes a lack in the Americans practise of setting terra-cotta to which we have previously called attention in an indirect manner, but which is in some respects so important a factor of successful work that it deserves serious consideration. Well designed terra-cotta is to all intents and purposes a mosaic composed of relatively small pieces of burnt clay. If properly considered, the jointings are a very important feature and influence very strongly the resulting effect, but no matter how carefully they may be devised by the designer, nor how truly the surfaces and angles may be molded and wrought by the manufacturer, if the resulting product is set carelessly or indifferently, without due attention to the desired effect, the terra-cotta will have an unsatisfactory, half-finished appearance. In this country, so far as we know, the setting of terra-cotta is generally entrusted to ordinary brick-masons, and it is rare to find a gang of men on a large building who have had special experience in this material. Mr. Cusack, in his article, alludes to a custom prevalent in England which might be copied in this country with eminent success. The British manufacturer of terra-cotta sets his own work, and either employs directly a trained staff of skilled workmen or sublets the setting to an experienced, responsible contractor who in turn makes the business a specialty, so that the setting of the material is immediately under the control of the manufacturer. This is as it should be, and is such an improvement over our own methods that the adoption of such a course by our builders cannot be too strongly urged. Even assuming that the average mechanic is willing to expend his best work upon the setting of the terra-cotta which comes to the building, an assumption which is by no means warranted by facts, it is nevertheless quite manifest that the best intentions cannot be depended upon to produce the best results in connection with a material which can be so easily disfigured or bungled in place as terra-cotta. The processes of evolution by which our builders and owners have been educated to a due appreciation of the intrinsic excellence of terra-cotta have been so slow that even now the material is seldom used for its full value, and though when properly applied and correctly designed it has been proven repeatedly that it can hold its own with any other material in the market, it is not easy to persuade a fastidious owner that it is a suitable material to be used anywhere within easy reach of the eye. He is likely to contend that those portions of a building which can be touched ought to be of another material, that terra-cotta is of practical no less than artistic value only when seen from a distance, and that its use for the front of a building implies a free, bold treatment which will not bear close inspection; the finished workmanlike appearance which is so easily obtained in some other materials being an altogether doubtful quantity as regards terra-cotta. This feeling, or, to express it more strongly, this lack of appreciation, undoubtedly arises from the indifferent habits of setting the terra-cotta with which we are obliged to content ourselves in this country. It is only one of the many evils which have resulted from the aggregation of small contractors under the head of a master builder, and, as Mr. Cusack very truly intimates, when we have once learned the secret of setting our terra-cotta correctly, we can carry it clear down to the ground and place it where it need not fear the closest scrutiny, where delicacy and sentiment in design can be appreciated quite as much as breadth and rough freedom. Terra-cotta, perhaps least of all building materials, can with impunity be slighted in setting. The joints and the courses simply will not take care of themselves, and the utmost care is required to so place the material that the poor workmanship will not obscure the excellent artistic qualities. A material which comes to the building, as it were, fresh from the hand of the artist surely needs no apology for itself. If we are to continue our stereotyped methods of handling building material, which are admirably adapted to grinding out quantity to an almost unlimited extent, we must expect that in the process the delicacies of terra-cotta are often to suffer, but there is every indication that our architects and manufacturers appreciate the loss which results from such a course, and the day is not distant when the setting of terra-cotta, while no less of a science, will be more of an art, and the material will receive the consideration it deserves.

THE T Square Club, of Philadelphia, is one of the few organizations that are thoroughly alive and are able to make their influence felt for the good of the profession, and it has done a good work in publishing in convenient and available form its Thirteenth Annual Report. One cannot glance over the summary of the work of its various committees without appreciating how much need there is for just such effort as this institution is able to render available and of tangible effect. The club has always put itself on record upon the important questions which have come to the front in Philadelphia within recent years, and whether in regard to its stanch attitude in support of the jury of awards for the Art Museum competition, or in its relation to the draughtsman through its admirably conducted competitions, the club has shown a worthy reason for its

existence and has merited the support which the best elements of the profession in Philadelphia have accorded it. The report emphasizes the necessity for a broader civic interest on the part of the architects and for a more personal share by them in their public duties as citizens who are trained to appreciate the architectural needs of a city in which the art element is passing through a very remarkable expansion. Let us hope the club may be able to do for Philadelphia what Haussman did for Paris.

OUR attention has been called to a development of the skeleton construction, which may almost be called the *ratio ad absurdum.* This scheme proposes an ashlar facing for office buildings and commercial structures consisting of a thickness of only two inches of terra-cotta, each block being separately held by a clamp carried back to the steel skeleton, the ashlar work standing out entirely free of the steel, so that a space of two inches or more intervenes. We have heard of buildings in Chicago in which the brick mullions for the windows were constructed with a T-iron faced with a single thickness of brick, each brick being wired to the iron with copper wires. Constructions of this sort are what tend to bring good honest brick and terra-cotta work into disrepute, and they are what have done so much to associate in the minds of conservative investors an idea of inherent shoddiness as a necessary concomitant of the skeleton construction, an association which fortunately is not justified by facts.

PLATE ILLUSTRATIONS.

PLATES 63 and 64 show the front elevation, details of same, and two floor plans of the Burnham Athenæum at Champaign, Ill., J. A. Schweinfurth, Boston, Mass., architect. The building is constructed of Powhatan white brick and terra-cotta to match, from Perth-Amboy Co.

Plates 65 and 66 show the front elevation, perspective, and ground floor plan of the M. E. Church, at Newton, Mass., Cram, Wentworth & Goodhue, architects. The materials used are gray brick and pearl-white terra-cotta. The roofs and domes are covered with copper. The interior shows simply a large auditorium in the form of a Greek cross surmounted by a dome, and with four arms covered with semicircular barrel vaulting. Groups of Corinthian pilasters support the semicircular coffered arches of the dome. The church has no galleries, and affords an unbroken auditorium. It is hoped that ultimately the dome and the large lunette in the chancel may be filled with wall-paintings. The Sunday-school building is so arranged that the seating capacity of the church may be increased by throwing in all the seats in the main schoolroom. The arrangement of the plan was made necessary by the limited dimensions of the lot.

Plates 67 and 68 show the Jackson Street elevation of the Great Northern Hotel, Chicago, D. H. Burnham & Co., architects. The entire front of this building is of white terra-cotta, very elaborately modeled, same being the work of the Northwestern Company.

Plate 69 shows the Colombier d' Ango, Verangeville, France.

This colombier, dating from early in the sixteenth century, is a most charming example of the use of different colors of brick and stone combined in surface patterns. The materials used are red and black brick, gray limestone and flint, the rough faces of which vary in color from light gray and yellow to a deep blue black.

The drum is 25 ft. 10 ins. in diameter, and 19 ft. 11 ins. high, crowned by a roof of small flat tiles, making the entire building about 36 ft. 6 ins. high.

The first story above the base is in two belts, the lower being a diaper pattern of red and black brick with a square set diagonally at the top. This square is very carefully made of four pieces of red and black where it can be seen from the court; but at the rear only two pieces of red are used. Limestone is used in the second belt for the larger squares, black brick stretchers and small red squares.

The second story is divided into several belts, the first being a series of small limestone squares separated by red brick; second, a narrow stripe of red brick with a simple figure in black; third, of large limestone squares set diagonally and separated by squares of equal size formed of smaller pieces of flint; fourth, a red brick course pierced with holes for ventilation; fifth, of another series of limestone, flint, red and black brick squares; and lastly, of the red brick cornice, which, on account of its slight projection, really counts more as another ornamental belt than as the cornice to the entire building. The roof is of red and green tiles delightfully mixed together.

The history of the building is also rather interesting as illustrating human nature and accounting for its extreme elaboration. At the time of its erection only the nobles might build dove-cotes without royal permission; therefore when François première gave the right to Ango of Dieppe, the richest man in France, he determined to build one which should surpass those of all the nobles, and although several others have since been erected which exceed it both in size and amount of ornamentation, it was, at the time of its erection, the largest and most ornate in the country.

Plate 70 shows the front elevation of the Quadrangle Club at Chicago. D. H. Burnham & Co., architects. The walls of the building are of red pressed brick with white joints and band courses of red terra-cotta. The broad frieze and cornice are white.

ILLUSTRATED ADVERTISEMENTS.

A GOOD example of how to treat a store, with offices, etc., above, and built on an extremely narrow frontage, may be seen on Boylston Street, Boston, just opposite the Common. A simple architrave forms an appropriate frame to the two first stories. The banded columns and pilasters to the stories above are excellent, and these features have *not* been disgraced by a galvanized iron cornice. The whole of the front is in terra-cotta, of good quality and finish, and the work has been carefully set, which is a matter of equal importance. The architects were Shepley, Rutan & Coolidge, and the work was supplied by the New York Architectural Terra-Cotta Company.

In the advertisement of Charles T. Harris, Lessee, page xxviii, is shown the front and side elevations of the new residence for W. D. Hollis, Esq., at Chicago. These illustrations show to good advantage the effectiveness of a tile-laid roof.

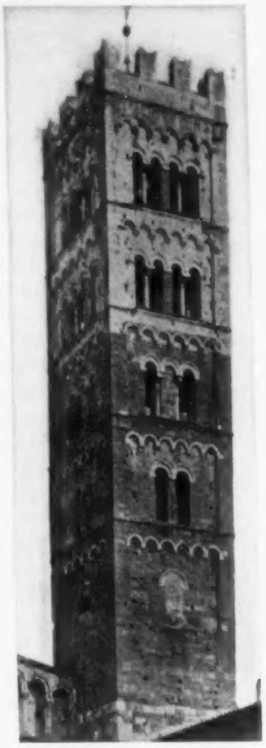
Italian Towers. II.

BY C. HOWARD WALKER.

IN the last paper the campaniles of Rome alone were mentioned, and in most cases they were the square towers of the basilican churches, built in the ninth, tenth, eleventh, and twelfth centuries. It is an interesting study to follow the development and changes of the campanile form through the Lombard period to the Gothic, and later to the Renaissance types. The sequence of variations is natural and readily interpreted. It is more evident in the plans, perhaps, than in the details or the elevations. The earlier towers are of square plan, perpendicular or but slightly battered from base to summit, and with flat or very low pitched roofs. The termination of the towers varies in different localities, partly from tradition, and partly from local conditions. In Rome, where, despite the internecine warfare of the Colonnas and Orsinis, the city was protected by the powerful arm of the church from its walls, and not from its towers, and no symbol of factions appeared upon the campanile; they are devoid of the battlements and machicolations so frequent in Tuscany. The Roman towers have distinct though slightly projecting eaves, and give no suggestion of a fortified watch-tower. Throughout the hill towns of the Apennines, and in the greater northern cities of the plains, both the towers of the Palazzo Pubblico and of the cathedrals were fringed with the forked parapet of the Ghibellines, or the stern, square-cut battlements of the Guelph, and because of the silhouette against the sky of crenellations instead of a roof, these towers form a distinct class by themselves. They may be found in Florence, Siena, Lucca, Pisa, Pistoia, Prato, S. Gimignano, and Volterra. A development of this form is the square tower, which is surmounted by a smaller tower of the same shape. The type is usually civic rather than ecclesiastic, and is seen at its best in the towers of the Palazzo Pubblico in Florence and Siena and in the Castello of Ferrara. The Florentine tower was built about the year 1300, by Arnolfo da Lapo; the Torre della Mangia, at Siena, from 1325 to 1345; and the Ferrara Castle towers in 1385. The variation of an octagonal tower above a square is more frequently adopted for campanile of churches than the preceding type, though it is contemporaneous with it. This form may have been derived from the East. It was used throughout Syria and in Cairo, and along the northern coast of Africa in the ninth and tenth centuries. In Italy it is usually crowned by a spire; although this is not always the case, as is evidenced by the tower of the Frari in Venice. With the introduction into Italy, at the middle of the thirteenth century, of Gothic forms and details, all the earlier forms of towers were further developed by the introduction first of high-pointed roofs or spires, and later by enlarged opening and Gothic detail. The fourteenth century is perhaps more prolific in towers in Italy than is any other period; and the beauty and grace of their long, delicate, perpendicular lines is unexcelled by the richer and more highly decorated towers of the northern cathedrals.

TOWER OF CATHEDRAL AT PRATO.

The Italian tower is always simple in mass and direct in expression, is seldom richly ornamented, excepting in its moldings, is comparatively lacking in finials, crockets, pinnacles, and the superabundant intricacies of the French Gothic, but in its delicacy of proportion and purity of line it compares favorably with much more ambitious architecture. Of the early type with parapet, the cathedral and S. Frediano at Lucca are excellent examples. Both of these towers were built about the end of the ninth century. They somewhat resemble the Roman campanile, except that they are more massive in proportion. The successive stories plainly announced upon the exterior are nearly equal in height. The string-courses, instead of being carried around the tower, are stopped by the long, perpendicular pilasters formed by the thickening and strengthening of the walls at the corners, and the corbels are replaced by a series of small arches, forming a corbel-course. The openings increase in number upon each story as the tower ascends. The parapets are of the Ghibelline type. [1] S. Pietro Somaldi, in Lucca — a church little known, has an excellent brick tower of the thirteenth century, with low roof without parapet. The belfry story is especially well proportioned.



CATHEDRAL, LUCCA.

The lower portion of the tower of the church of S. Maria [1] Maggiore, at Barletta, is of the twelfth century and of very dignified proportions; the termination of the tower, while excellent, bears evidences of being of much later date. Perhaps the simplest and, in many ways, the most impressive of these early towers is the northern tower of San Ambrogio, in Milan, built in 1129. It is almost entirely devoid of detail, but is most successfully proportioned in relation to the façade of the church as seen from the atrium. The tower of the cathedral of Prato has strongly pronounced belt-courses, in this respect resembling the Roman towers. Its detail, however, is dis-

S. FRANCESCO, ASSISI.

[1] The towers of S. Francesco and of the cathedral in Assisi are good examples of the early type.

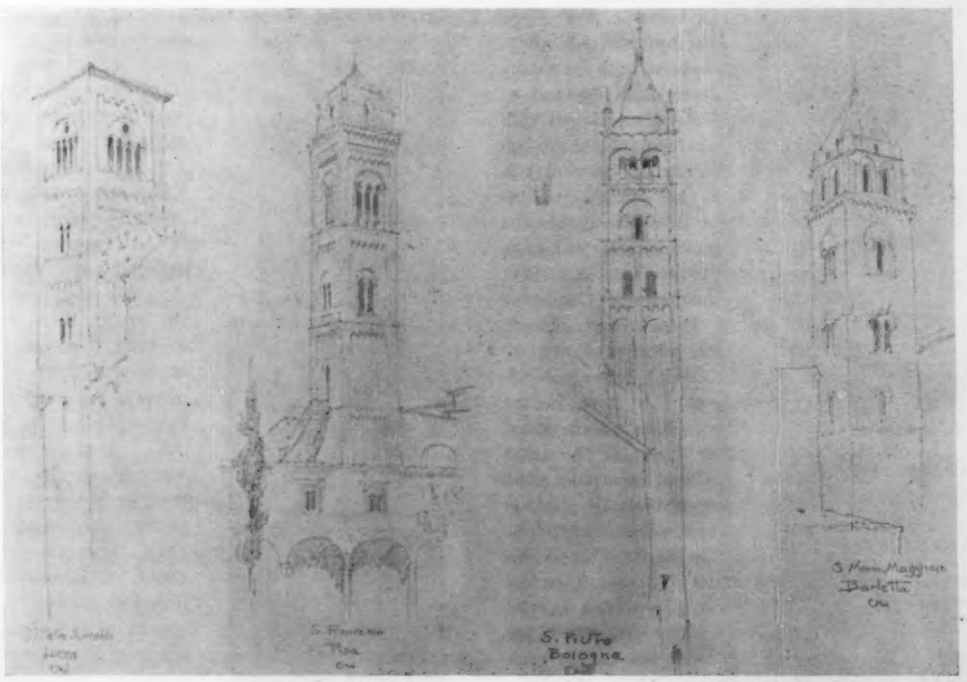
tinctly Gothic, of fourteenth century character. [1]S. Pietro, in Bologna, has a most unusual campanile, not only in the disposition of the window openings, but also in the peculiar form of the spire. This tower was probably built early in the fourteenth century, but its pinnacles and the peculiar form of its roof may be of later date. It is slender and graceful, yet does not lack an imposing strength. The tower of S. Maria Novella, in Florence, built about 1300, is peculiar in that it has a very steep and high spire-like roof and gables. This roof is badly proportioned, and seems inferior to the rest of the tower. The most delicately proportioned of all the thirteenth century campanile is that of S. Francesco in Pisa,[1] — a church little known and seldom photographed. The tower is slender, with fine lines and exquisitely proportioned detail of a Gothic character, so disposed that the corbel and string-courses seem to sparkle with light and shade. The top story is a somewhat awkward addition of later date, although from its Gothic character it cannot have long antedated the original tower. With the exception of the tower of Vicenza, there is no tower in Italy that gives more the impression of subtlety and delicacy than does that of S. Francesco.

S. MARIA NOVELLA, FLORENCE.

In nearly all Italian towers before the period of the Renaissance, the moldings are few, being principally string-courses of double cymas, or a cyma and a cavetto. These string-courses marking each story are usually placed on the sill line of the openings, but occasionally at the actual line of the floor itself. The string-course is enriched by a single or double row of corbels below it, with molded or carved faces, or by an arcaded course or richly detailed brick cornice course. The long buttress-like forms at the corners are of but slight projection and seldom have the line of the inner reveal carried intact full height, as the face of the buttress is usually flush with the face of the corbel course and fuses into it so that the buttress line is broken below each string-course. The eaves project but little more than the string-courses, and the point of the base of the rafter is kept well inside the ashlar face of the tower, thus avoiding the heavy effect of hopper roofs of any angle where the pitch of the roof begins at or outside of the face of the wall. The walls of the towers batter slightly, producing by this means an additional impression both of solidity and height.

CATHEDRAL, ASSISI.

The batter of a wall is best when it is not immediately apparent and when it increases perpendicular prospective without announcing its existence. The batter of the walls is a regular slope, not an entasis. It is probable that a slightly curved batter would be even more effective, tending to lead the eye upward by a more subtle line. The lightening of the upper stories by increasing the size and number of the openings, thereby producing greater delicacy of effect, is common to all the later Italian towers.

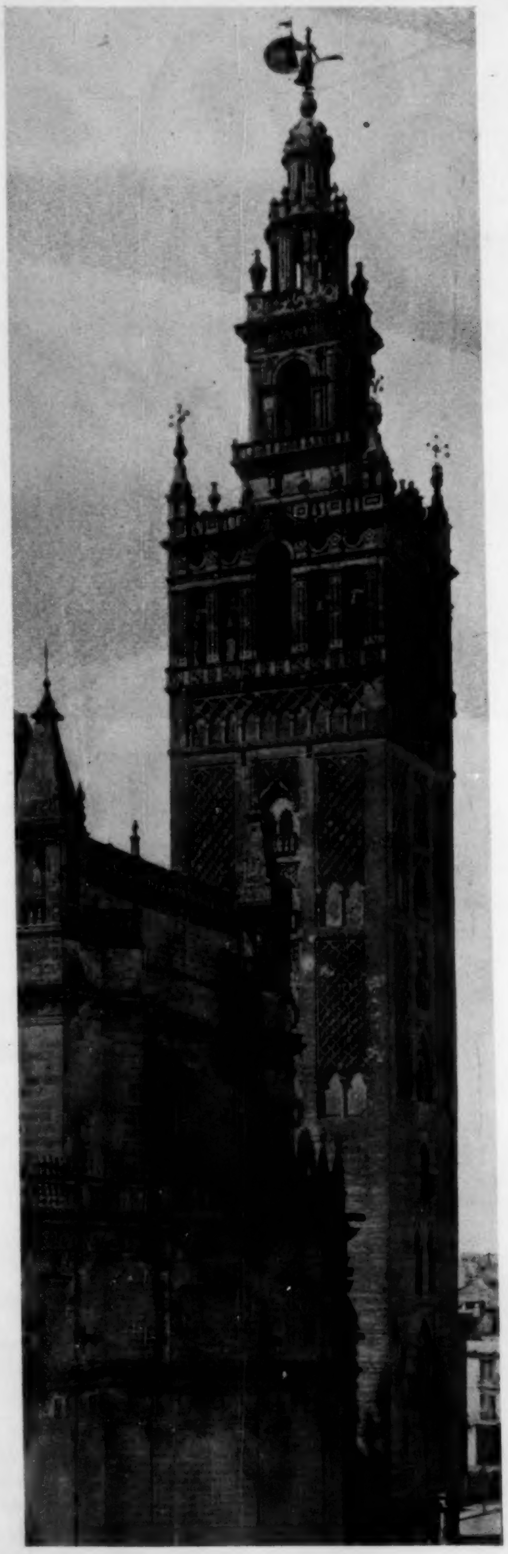


[1] The towers of S. Francesco and of the cathedral in Assisi are good examples of the arly type.

Spanish Brick and Tile Work. III.

BY C. H. BLACKALL.

THE Moors never made any very serious use of stone in connection with their architectural structures, having a marked preference for brick or terra-cotta. Their architecture as developed in Spain was so purely a matter of decoration, and the materials themselves generally counted for so little, that this preference is easily understood. With the tendency to work from a small unit up to large decorative results, and the geometrical as well as the painstaking bias of Moslem art, the small unit afforded by a bit of burnt clay was, from their standpoint, more manageable than huge blocks of masonry; or, to put it another way, the Moorish art was built up, in distinction to the practise in nearly all other countries of, so to speak, cutting down. Consequently, whenever the Moors did undertake to use stone, they fell very easily and almost inevitably into forms and arrangements which are essentially of brick or terra-cotta origin, and it is well worth while, in considering the general subject of Spanish brick and tile work, to include one of the most notable of these stone attempts, namely, the Mosque at Cordova, a structure which of itself has been ranked as one of the marvels of the world, and which never fails to arouse the utmost enthusiasm on the part of every artist whose good fortune leads him to the ancient city of the Moslem Caliphat. Ab-der-Rahman, in 770, after declaring himself independent of the sovereignty of the Caliphs of Damascus, resolved to erect at the center of his Spanish empire a mosque which should be of surpassing grandeur and magnificence. In plan, the building consists of a vast rectangle enclosed by heavy outside walls, with a low, vaulted roof supported by a forest of isolated columns, which are said to have been stolen outright from old Roman and Christian temples, and cut off or pieced out to the required length. They are of rare marbles, porphyry, jasper, and other precious stones, and stretch out indefinitely in every direction, giving the idea of vast expanse and a bewildering maze of architecture. The columns are connected by a double row of arches, the lower simply acting as a brace, and the upper arches directly supporting the vaultings. The arches are in bands of red and white, the red being apparently formed with brick and the white with stone, though in some cases this seems to be all stone and the construction has been painted and stuccoed so often that it is hard to determine the exact material. Apart from the shafts of the columns, the architecture is essentially brick and terra-cotta in its appearance.

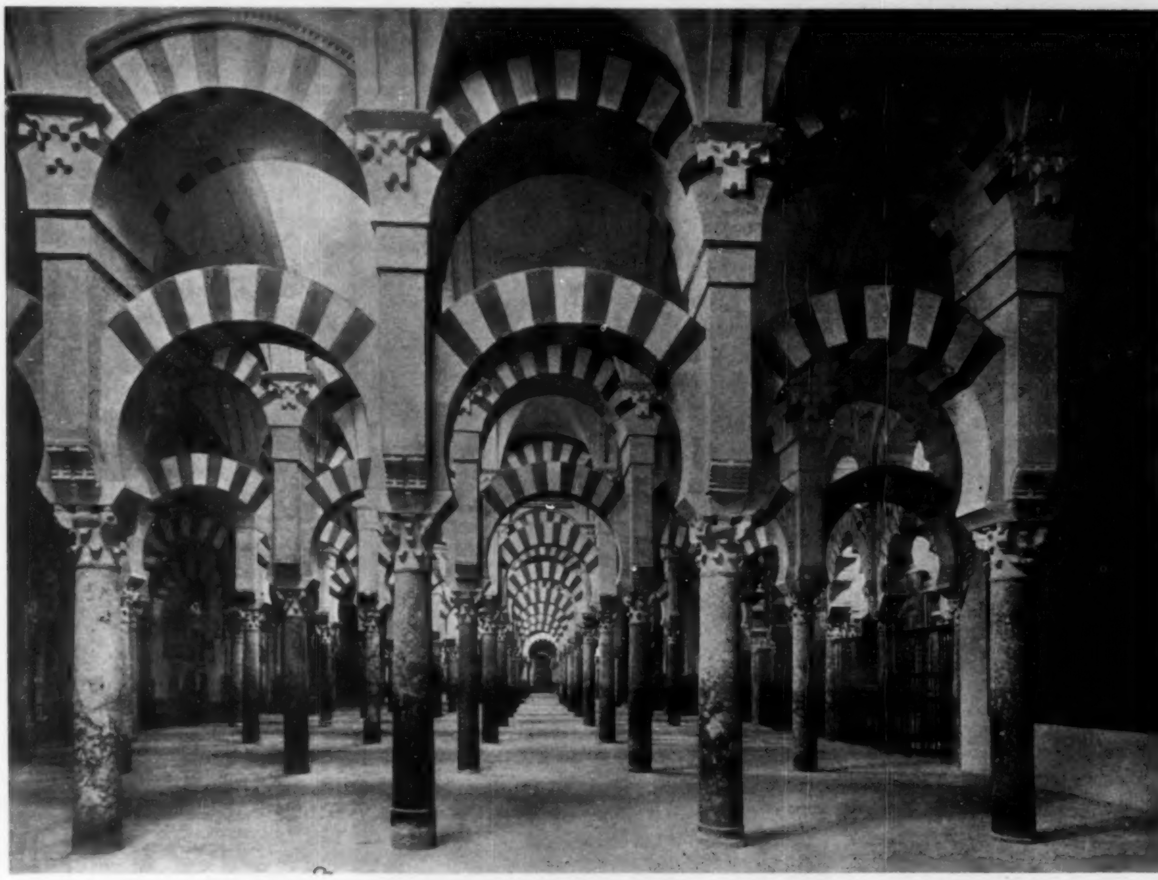


THE GIRALDA, SEVILLE.

Theophile Gautier, who was so keenly alive to the beauties of Spanish architecture, characterizes this mosque as having a richness, a beauty, and a fairy-like elegance of which the equivalent has been found only in the "Thousand and One Nights," and which owes nothing to any other period of art. Never were lines better chosen or colors better combined. It shows the Arab civilization at its highest development, and rises to a dignity of conception and a grandeur in execution never excelled in any of the Arabian work, either Eastern or Western, having all the delicacy, the beauty of fine detail, which characterizes the Alhambra, but with a breadth of treatment and a certain simplicity of general intent such as is seldom found in Moorish work.

The ancient city of Seville is wonderfully rich in architectural remains of all the periods which have found manifestation in Spain. Of brickwork, purely as such, the examples are few, but they are worthy types of their kind. Annexed to the church of San Marcos there is an interesting Moorish brick tower, one of the oldest of its kind and very dignified and graceful in its treatment. In its treatment of wall surfaces and its use of detail it is a considerable advance over the Toledo and Northern examples which have been previously illustrated, and the crowning belfry, although a later Christian addition and of manifest incongruity of style, matches very cleverly with the feeling of the lower portion, and it is quite possible that the original Moorish termination was not unlike what now exists.

The example of Moorish brickwork which is accepted as perhaps the most perfected of its kind is the tower of the Seville cathedral, known, by reason of the weather-vane on the top, as the Giralda. This, however, like other Moorish towers, is a mixture. The portion up to the bell deck was erected about the year 1000, and was originally used as an observatory, forming a part of an old Moorish mosque, traces of which are visible in the adjoining walls of the cathedral. The upper portion was added by the Christian conquerors in 1668. The crowning figure of bronze, which weighs over three thousand pounds and is pivoted to turn with the wind, is undoubtedly a late Renaissance addition. The Moorish portion of the tower, and a great deal of the upper portion as well, is entirely of brick, and so well constructed and of such excellent material that the angles and jointings seem to be as sharp as though laid within the present generation. The



INTERIOR OF MOSQUE OF CORDOVA.

treatment of the wall surface is similar to what has been noted elsewhere in Spain, and, combined with the delicately designed openings, gives an exceedingly harmonious and pleasing result. The design as a whole could doubtless be greatly improved. The inconsistencies of style are quite manifest, and the details of the Renaissance portion are by no means on a par with the delicate Moorish tracery; but there is hardly a tower anywhere in the world which is quite so satisfactory as this splendid shaft. It rises to an altitude of something over three hundred feet, and the horizontal dimensions imperceptibly diminish in height so that the towering appearance is greatly enhanced. Inside there is a ramp with easy slope, paved with bricks, which is carried up in a spiral of a width sufficient to permit two horsemen to ride abreast. The existence of this ramp is slightly accused on the exterior by the difference in level of the openings.

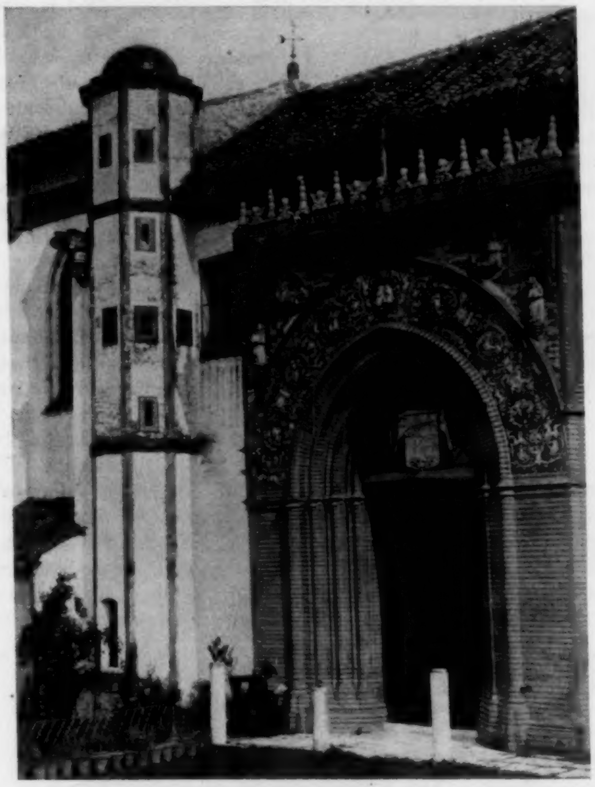
A study of almost any type of Spanish architecture is apt to prove disappointing on account of the lack of precise information and of exact documents. The Convent of Santa Paula, at Seville, is an instance in point. Very

SAN MARCOS, SEVILLE.

little information can be gleaned in regard to it except the fact that it was founded in 1745. It is in some respects the most distinctively Spanish piece of work which could be cited as illustrating the tendencies of the composite art which succeeded the Moors. The tympanum over the doorway has a ground of glazed tiles in the strong, deep colors which are so characteristic of Southern Spain, with a coat of arms in low relief occupying the center. The broad band outside of the arch moldings is also of glazed terra-cotta, the medalions representing scenes from the life of the saint, and the groundwork surrounding them being decorated in the most elaborate late Italian style. The medallions merit a closer investigation than the accompanying photograph will permit. They are in a low relief, and are beautifully modeled in a manner which recalls very strongly the Della Robbia work on the Pistoja Hospital. This Spanish example lacks the naive, direct expression of the Italian work, but the modeling is quite as good, and there is a sense of delicacy and refinement about the little figures which arouses a wonder that they should be put side by side with such elaborate

Rococo ornament. It is the kind of work which will bear the closest inspection in detail, while at the same time the effect of the general color is extremely striking, with the red and white banded work below and in the arch, and the dull, strong glazes of the tiles. The spandrels of the arch are likewise filled in with a groundwork of enameled tile, the figures and the monograms of Ferdinand and Isabella being modeled in high relief. There is also a band of encaustic tiles forming a part of the parapet above the cornice. The tourelle at the left of the doorway is built of brick, the material showing at the angles and around the openings, while the wall surfaces are stuccoed white. The treatment of the small windows is very pleasing. They are enclosed by a broad band of encaustic tiles in strong colors, and give a delicious little bit of color by contrast with the red brick and the white wall surface.

The type of work which is represented by this portal of Santa Paula corresponds very closely with the style which was exported to



SANTA PAULA, SEVILLE.

Mexico and Florida and reproduced in many of the Spanish-American cities. The combination of the red brick and whitened wall surfaces, or of brick in two colors with splashes of vivid faience, will seem familiar to all who have visited the southern parts of this country and Mexico. It is a charming manifestation of terra-cotta possibilities, which with more care in detail and a fuller consideration for mass, can lead to most excellent results.

(*To be continued.*)

CLUB NEWS.

THE Chicago Architectural Club will hold its next annual exhibition in the Art Institute, March 2, 1897.

The St. Louis Architectural Club will hold an exhibition of the club work at some time during the coming spring. The question of taking up architectural history in connection with the club class in architecture, by having lectures once or twice a month, illustrated with stereopticon views was considered, and a committee appointed to take charge of the work.

The Art of Building among the Romans.

Translated from the French of AUGUSTE CHOISY by Arthur J Dillon.

CHAPTER III.

CONSTRUCTION IN WOOD.

GENERAL REMARKS ON THE METHODS IN USE AMONG THE ROMANS.

(*Continued.*)

UP to this point we have studied the ancient roofs only in the original monuments and in texts.[1] It will, perhaps, be more to the purpose to inquire if the tradition of the Middle Ages cannot also reveal to us some facts. The modern roofs of Italy differ but little from those that were raised at the beginning of the Middle Ages; all are more or less like those of the Christian basilicas, and these, built when architecture had no other principles than the more or less accurate memories of the Roman art, are evidently only copies whose models have not lasted until the present time. Such is the chain of tradition that binds to antiquity the ordinary types of modern Italian framing. To retrace this line and show the analogies would be to repeat what has already been said in most excellent works.[2] I will cite only one example, that of the roof of the ancient basilica of the Vatican, whose details I reproduce in trying to interpret a very crude drawing by Carlo Fontana (Fig. 90).

The most remarkable thing to be observed in this drawing is the grouping of the trusses by twos, with an intermediary post, and the seemingly intentional avoidance of oblique pieces. There are no struts, no cross-braces; a simple tie binding the principals near their centers prevents bending, and their wide bearing makes side bracing to keep them vertical unnecessary. And when one examines the details, it is seen that the assemblage nowhere weakens the pieces; an iron pin fastens the upper tie to the principals. The king post cuts neither into the tie which it carries nor the collar beam it meets; it even seems that the contractor preferred the use of stirrups and ties of metal to complex assemblages, where the wood would not

[1] In order to complete the review of the principal texts relative to ancient framing, I should call attention, first, to the notice which Vitruvius gives it in the fourth book of his treatise (Cap. II.); but this notice, whose object is to show the analogies between the structure of edifices in wood and that of the ordinance of Doric temples, is so vague that we can learn from it, strictly speaking, no details special to ancient framing. I could not pass over it in silence, but I think it would be superfluous to translate it. Second, an inscription commented on in turn by Ottfr. Muller and M. Rangabe ("*Ant. Hell.*," 771) gives the arrangement of a roof with one slope that covered the long walls of the Pirea. This shelter, however, was of an elementary simplicity, and the interest of the inscription is only that it adds some words to the vocabulary of the art of framing among the Greeks. Third, a more significant text that treats of a roof of the basilica of Fano. (See "*Vitr.*," Lib. V., Cap. I.).

M. Viollet-le-Duc drew from this passage the elements of a restoration, that, as a whole, gives the essential traits of a Roman truss. Two roofs in the basilica of Fano crossed at right angles, and Vitruvius took pains to insist on the equalizing of the two trusses. It is seen from his description that the ancients simplified the intersections of their roofs with the same care that they took to avoid penetrations in their vaults. No diagonal trusses or hip trusses; one of the roofs was continuous, and the other framed directly into it. See, for the details of this ingenious combination, "*Les Entretiens Sur l'Architecture*" (5th *entretien*). Fourth. Finally, two restorations of ancient roofs made from ruins; that of the odeon of Regillæ, by M. Tuckermann (*das odeum des Herodes Atticus in Athen*), and that of the temple of Pæstum, by M. Aures (*Etude sur les dimensions du grand temple de Pæstum*); this last work shows, by a curious example, how much value an exact knowledge of the harmonic laws that decided their dimensions is in the restoration of monuments.

[2] See in particular Rondelet's "*L'Art de Batir*," Lib. V., 1st section, and "*Le Traite d'Architecture*," by M. Leonce Reynaud, part 1, Lib. III., Cap. I.

The framing of the ancient basilica of St. Peter is known to us through the work entitled "*Il Tempio Vaticano*" (p. 99), and by a view preserved in the church of St. Martin of the Mountains in Rome. The age of this framing must not, however, be exaggerated. I cite it only as a type, not as an authentic example. The entire roof of St. Peter's was rebuilt under Benoit XII., at the beginning of the fourteenth century, and there is no reason for believing that this construction is of any earlier date. I could have taken with equal reason an example from the basilica of St. Paul, which lasted almost to our days, or from the ancient interior of St. John Lateran, which is known by the paintings in St. Martin of the Mountains, or even from the roof of Sta. Maria Maggiore, which dates from the fifteenth century; any of these examples would have justified the same observations and the same conclusions.

be open to the air and might dry-rot. In uniting them by juxtaposition he avoided this danger as much as possible, and the simplicity itself of the construction is the principal guarantee of its durability.

An important question about the truss we are examining is whether it was to remain in sight or to be concealed by a ceiling. The answer seems uncertain. Saint Paul, outside the walls, a building of the same date as the basilica of the Vatican, had — as we know

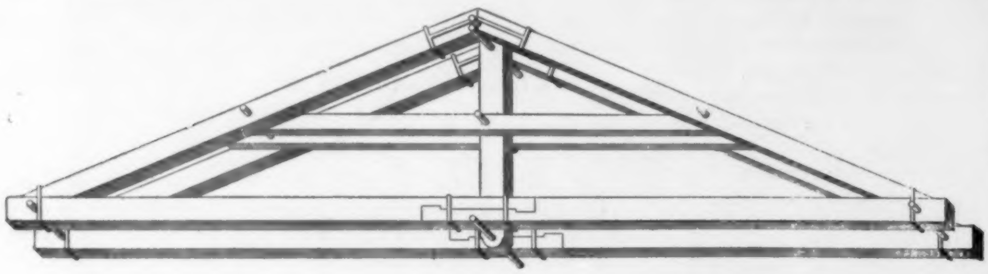


FIG. 90.

from Eusèbe — a horizontal caissoned ceiling. Other monuments, more ancient than the basilica of Fano, had convex, or, at least, broken ceilings, that left the ties and lower members of the trusses uncovered. Perhaps one or the other of these forms was originally used in the Vatican, but at the end of the Middle Ages there remained not the slightest vestige of a ceiling of any kind; and I do not know that a ceiling would have added to the beauty of the edifice. The objection to visible trusses is the complication of their lines, and this complication comes principally from the oblique pieces which, crossing each other in all directions, give to the framing an incorrect and uncouth aspect. Here there is nothing of the kind. Reduced to the elements of which it is composed, the truss has in its general forms an extreme simplicity and perfect regularity. The horizontal direction of the ties and collar beams is clearly and frankly visible, without confusion and without disorder; and it can be said, in summing up the impression produced by this truss, evidently inspired by ancient models or ancient traditions, that it worthily partakes of the severity of style that Roman architecture had the fortunate privilege of preserving up to the last moments of its decadence.

Wooden roofs, such as we conceive them from the imitations of the Middle Ages, were characteristic of two periods of Roman architecture, of its rise and that of its decadence. To the intermediary period, above all, belongs the vaulted construction. But by a singular circumstance, and one that shows the power of tradition in Rome, it was with difficulty that the vaults replaced the wooden coverings when the form of the building had been fixed by ancients' usages; and it was to edifices erected for new purposes that they were first applied, as, for instance, to the public baths, institutions unknown to the ancient Roman republic, and whose introduction dates from the time of Agrippa. The temples, on the other hand, did not cease to be built according to the ancient mode; sometimes the ceiling of the cella [1] was replaced by a vault, but on the exterior the porticoes of columns covered with wooden roofs were never changed. The basilicas, though the ancients attributed to them no sacred character, always preserved their primitive aspect and were always covered with wooden roofs; the tradition in this respect was so constant that we can look on the basilica of Maxentius as an isolated exception in a series of basilicas that commences one hundred and eighty years before our era and extends to the end of the empire in the monuments of Christian architecture.

Nevertheless, while preserving the consecrated type of their ancient roofs of wood, the Romans sought at an early date to replace the wood with a less perishable material; sometimes, and principally where wood was scarce, they substituted arches of brick for the trusses;[2] elsewhere they used bronze, an easily worked metal, whose assemblage is still more easy. Sometimes they made only the principal members of the trusses of bronze, but in other cases they excluded wood entirely, making the trusses, and even the roofing, of metal. Before them the Greeks had made some efforts in this direction; Pausanias[3] gives the description of a circular edifice where the rafters of the roof converged, like the spokes of a wheel, toward a central piece of bronze. There is even to be found in his "Journey in Greece" the mention of an edifice cast in bronze, whose name recalls the material of which it was made, — the temple of Minerva Chalciœcos. But these applications were of little importance; it was by the Romans that the idea was generalized and extended. There one sees the roof of the Ulpiennian basilica, entirely of bronze; and the roof of the great hall of the Baths of Caracalla of the same metal. As soon as the first century before our era, bronze was used by the Romans, to the exclusion of all other material, for the trusses of the portico that precedes the rotunda of Agrippa.

This celebrated piece of framing lasted until the middle of the seventeenth century, and the architects of the Renaissance were able to examine and describe it. They have left us some drawings of it, but through irreparable negligence they made them so vague and so incomplete that it is hardly possible to distinguish anything more than the general form of the structure, and its general arrangement. Figure 91 shows what Palladio described; it is a reproduction of his drawing, corrected after attentive study of the traces

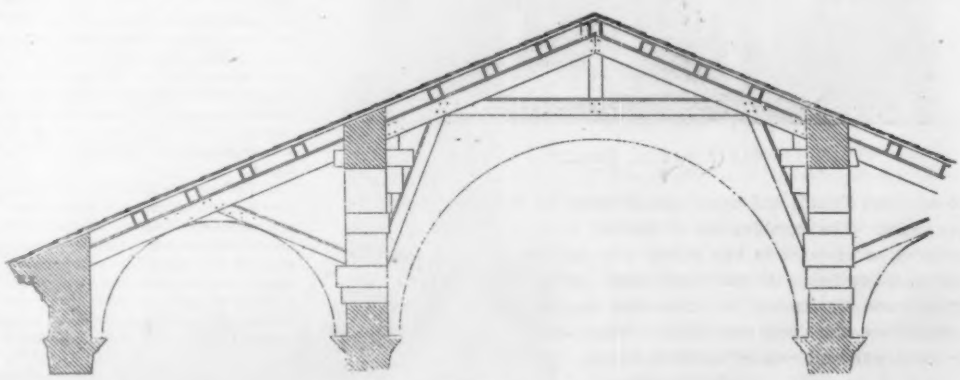


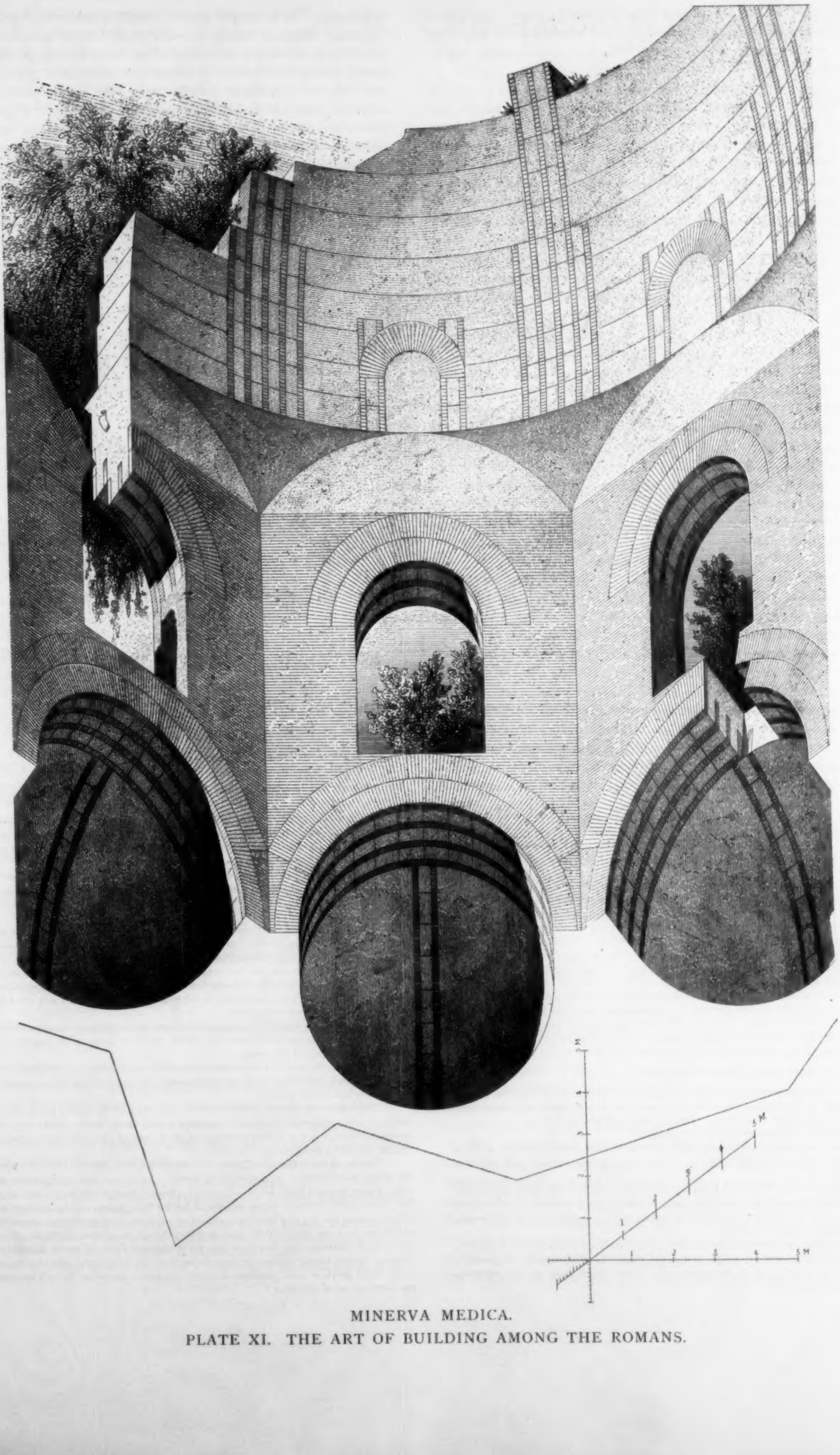
FIG. 91.

left by the framing on the monument itself. These indications are of various kinds; the corbels that aided in supporting the roof of the central nave have their lower angles chambered off to make room for the braces, and thus fix the inclination of these pieces; the holes that received the ends of the purlins fix the number of these,

[1] See, on this subject, a curious passage in the commentary of Servius on the "Eneid" (I., 509.)

[2] See Philon of Byzance ("*Vet. Mathem.*," p. 87), and also the graphic interpretation of the text given by M. de Rochas in his translation of Philon.

[3] The Philippeum of Olympia is described by Pausanias ("*Elid.*," Cap. XX.). See for the temple of Minerva, Chalciœcos, Pausanias, *Lacon.*, Cap. XVII.; in relation to the Ulpiennian basilica, Pausanias, "*Elid.*," Cap. XII.; "*Phoc.*," Cap. V., and for the "*Cella Solaria*" of the Baths of Caracalla, Spartian, Cap. IX.



MINERVA MEDICA.

PLATE XI. THE ART OF BUILDING AMONG THE ROMANS.

and the rear wall of the portico gives the exact curve of the bronze vaults that were used for decoration, and consequently shows the height of the lateral trusses; from this their construction can be deduced.

It is useless to seek for the details in Palladio. He drew only a section at a small scale to explain the assemblage, a sketch that can only be understood by the aid of other data which are in themselves quite incomplete, such as a sketch by Serlio and a few scattered notes in writings of the seventeenth century. "Each beam," says one of these allusions, "was composed of three thick sheets of bronze assembled with nails of the same metal,"[1] and in accordance with this description, Serlio shows the portico of the Pantheon with the purlins in the form of a trough. There is, I think, but one way of reconciling this drawing with the description above quoted; it must be admitted that the three plates of bronze of which each beam was composed formed the three sides of a trough. The drawing by Serlio and a text by Donati shows that the troughs were upside down, so that it was only the plates forming the sides that were active parts of the beam, the plate that formed the bottom serving principally to prevent lateral deflection. The architect, however, seems to have been guided less by principles applicable to the use of metal than by his memory of wooden construction. The trusses of the Pantheon were not different from ordinary trusses made with built-up beams, and were made in the manner that would be naturally the first to come to mind; but we may ask if it would be the best way to-day. It is open to doubt. Modern industry, in supplying us with iron beams of forms that can be said to be infinite in variety, allows us to distribute our material far more advantageously, and it would, perhaps, be foolish to imitate this example of a too primitive art. But it is sufficient only to pause over these methods of construction that an isolated edifice gives us scarcely a glimpse of. There are still to be examined two types of works of an entirely different character, bridges and the towers of attack, which the ancients built about besieged towns.

On the subject of military framing, the architect Apollodorus gives a series of principles of which some were certainly applicable to all the rapid construction of the ancients. "These works," he says, "should be made of wood easily found in the forests, varied in their forms, very restricted in size, light, capable of being constructed by the first workmen chance may bring to hand, and quickly erected, simple to repair, protected from surprises, easily transported, slightly combustible, difficult to demolish, easy to take to pieces."[2]

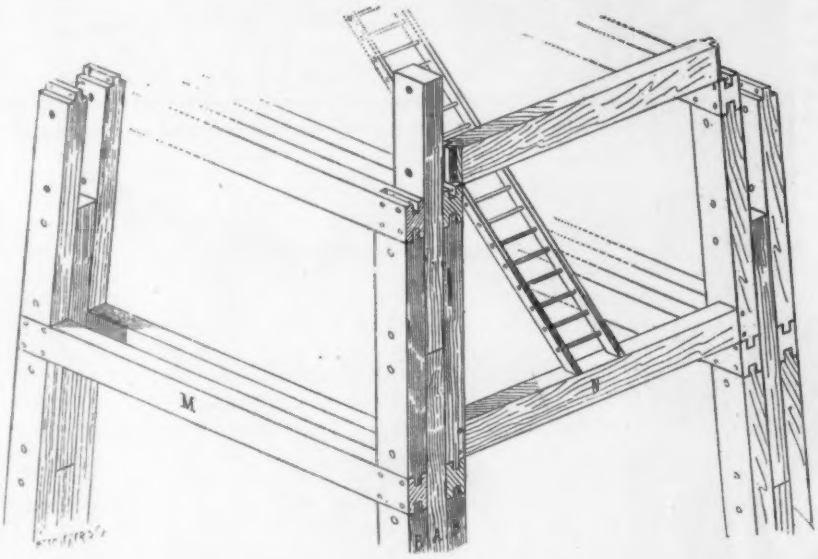


FIG. 92.

Such were the conditions to be met. An example will emphasize what was common to all, and we will take it also from the treatise on the attack of fortified places, by Apollodorus (Fig. 92).[3]

Here is, according to the description he gives, the probable aspect of such a tower. The admissible method of construction, as well as the advantages of it, is clearly shown in the figure. What was wished was to avoid the use of pieces of large size, which were extremely rare in certain countries, and which are always difficult to

[1] "I travi pur di bronzo maestrevolmente fatti chaischeduno con tre grosse tavole da chiodi pur di bronzo connesse, si son veduti a nostro tempo, finche Urbano VIII., l'anno 1627, le levò per farne all' altar maggiore della Chiesa di S. Pietro colonne, ed à Castel S. Angelo artiglerie, ponendovi in loro luogo travi di legno" (*Nardini*, "*Roma Antica*" VI., 4.)

Here is also another text of the same epoch, which confirms and emphasizes the above general explanation: "In ejus porticu æreæ tabulæ fuerant crassitudine quadrantis, ita commissæ, ut in fastigium ab epistyliis elatæ, unam vero superne expansam duæ in extrema ora utrinque suppositæ, alterique transversim conjunctæ fixæque trabalibus clavis, tigillorum tectique oneri recipiendo firmarent." (*Alexander Donatus*: "*De urbe Roma*," Lib. III.; *in the* "*Thesaurus ant. rom. of Grævius*," Tom. LII., p. 755.)

A clue given by Scammozzi is not less unmistakable: "Travi composte de tre tavole di buona larghezza e grossezza di bronzo; cioè due che fanno i lati, ed una di sopra confitte insieme con pironi di metallo" ("*Architt. Univ.*," part 2, l. 8, Cap. XIX.).

One can also consult, on this question of the bronze framing of the Pantheon, Ficoroni, "*Le Vestigia di Roma Antica*," p. 152. These are the principal existing accounts; the Piranesi, whose works give so many important details of the construction of the Pantheon, were not able to make any examination of its framing.

[2] "*Poliorcétique des Grecs*," edit. Wescher, p. 139, l. 5.

[3] "*Poliorc.*," p. 164 and seq. The ties M are the διπλᾶ ζυγά of the text and the interties N the ἐπιζυγίδες. The piece A forming the center of the post at the corner is called μεσοστάτης, and the two adjacent pieces παραστάται. The text can be translated thus: —

"How an attacking tower should be constructed.

"If we have to construct towers near walls, we should make them on rollers, at such a distance from the walls that they cannot be reached by projectiles, and of small pieces of wood, as follows: —

"Two squared pieces, of unequal faces, are assembled with the wide faces toward each other, the narrow face turned down (see M, Fig. 92); two pairs; length, 16 p., depth, 1⅙ p., thickness, 12 d. If, however, it is necessary to make a tower of more than 40 p., the length, depth, and thickness must be increased.

"These two pairs are laid on the ground with a distance between each pair of about 12 d., and separated at the top by about 1 p. to receive the pieces A, which reach to the ground; their length is 16 p., depth, 1⅙ p., thickness, 12 d. These pieces, fixed by keys, mortises, and cleats, remain vertical.

"To these vertical pieces, which form the center of the corner posts and which are four in number, other pieces of the same thickness and the same width, and 9 p. long, are fastened (B); in all, eight pieces. These pieces, which rest on the lower ties, are fastened to them by irons as well as to A, so that the three pieces together form a single corner post.

"These new pieces are crowned by ties like and parallel to the ties M (here the text, it would seem, should be punctuated in this manner), ἐπιτίθεται ζυγὰ παράλληλα τοῖς κάτω δύο κ. δύο ἐπιτίθενται ὁμοίως, κ. τ. λ. and, just as below, the ties are surmounted by interties N.

"Then, against the corner posts from one course of ties to the next, other pieces are placed, enclosing the square and surrounding the lower platform, fixed by means of keys and mortises; thus the four sides form one solid body. The interties N should be of the same length as the ties M, so that the four corner posts will be equally spaced in all directions.

"In the space left between the lower ties M, wheels higher than the pieces M are placed, projecting beyond the lower face, so as to raise them from the ground and allow the whole system to be moved and rolled along.

"In the same way, to the upper pieces that form the corner posts (in place of ζυγοῖς, read ξύλοις) ties and interties are fastened, like those below, in order to tie together the upper part of the first story of the tower.

"Moreover, the upper ties and interties should be 1 p. shorter than the lower ones, so that the construction, battering instead of overhanging, will not oscillate if overloaded, but will have a firm base on the ground.

"Nevertheless, guys should be attached to the tops of the corner posts, and stretched out in all directions, so as to give, as it were, a second larger base. These guys should be fastened either to stakes furnished with pins, or to pegs of iron with rings, driven into the ground obliquely, so as to resist the pull.

"This being done, the central piece A of the corner posts will be found to extend above the pieces fastened to it by a third of its length. In its turn this central piece will have other pieces fastened to it, which will extend above it, and whose height will be 9 p. On the central piece a similar piece, supported by the side pieces, will be placed; then there will be placed the ties and interties; and so on until the construction is completed. The central pieces A are not taken the same length as the others, so that the joints will not coincide but will alternate, and the corner post get its strength from the pieces fastened together. Finally, ladders resting against the interties traverse the tower from side to side; and thus, using small pieces in small numbers, fastened together, a tower can be built as high even as the fortifications of the place."

handle; to employ, as the author of the original description says, only pieces of small scantling was the object that was put before all others; and the ingenious system of splicing which he applied to the corner posts accorded most happily with this essential condition.

This construction is not cross-braced; and it is to be remarked that almost no description advises cross-bracing for engines of attack. Perhaps this was suppressed in order to give a certain elasticity to these constructions, which were subject to the shocks of heavy projectiles; but I rather think that the rarity of oblique pieces is a characteristic common to all the wooden constructions of the ancients; we have seen above that hardly any use of such pieces was made in Italy at the time when the art of framing was directly connected with the Roman traditions; and it would be difficult to find examples either in the paintings of Pompeii or in the miniatures which decorate the celebrated manuscripts of Terence and of Virgil of the Vatican. Here, however, the assemblages are perfectly rigid. In order to make the drawing clearer, I showed the joints ironed together, as would be done to-day; the real assemblage such as given in the text of Apollodorus, and in a commentary byzantin[1] were as shown in Fig. 93.

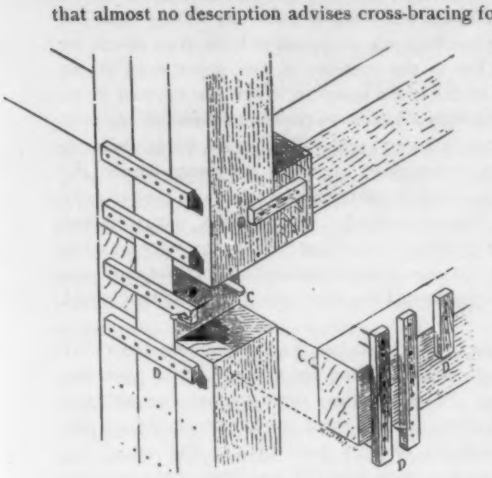


FIG. 93.

In this system, keys, or rather dowels of wood, cylindrical in form, fasten the side pieces to the center ones. They prevent the pieces from slipping on each other, but not from separating; and to prevent this, the pieces are fastened together by cleats of wood such as D, on their faces. The dowels were but big pegs; the dowel holes, auger holes; the cleats, slats or thick laths, simple strips of wood; it does not seem possible to imagine a combination more rapid or more practical. Tradition has partially preserved this method of assemblage; and to-day the verticals of the scaffolds in Rome are made up of small pieces, fastened together by nailed strips; Fig. 94, drawn from one of these modern applications of the system, will aid in the conception of the construction of the built-up pieces of the military constructions of the ancients.

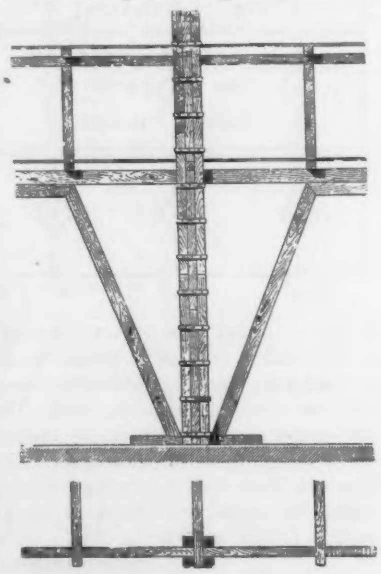


FIG. 94.

[1] Héron de Byzance, "*Poliorc.*," p. 226, l. 18 and following; p. 240, l. 5.

The tenon dowel C, which the Byzantin author likens to the extremity of the hinge style of a door, is the περιτομίς of the text.

The rounded mortise or dowel hole which receives this tenon or dowel is called χελώνιον; this mortise or dowel hole — evidently made with an auger — is terminated by a hemispherical concavity which causes it to be compared to a hollow hemisphere.

And finally the cleats, such as D, preventing the spreading of the pieces, is given in the text the name κανών.

Fire-proofing Department.

SOME EXPERIENCES OF MODERN FIRE-PROOFING MATERIAL IN ACTUAL TESTS.

BY PETER B. WIGHT.

IT is an old saying that "the proof of the pudding is in the eating thereof," and not at all inapplicable to the "all-devouring" element fire. We hear of all sorts of experimental tests of fire-resisting building materials, but somehow when the building in which they are used takes fire, the results are not always the same. Sometimes those in which some of us had put great faith succumb to slight conflagrations, while others show better results than when we experimented with them. Some serve their purpose well, and others tumble down and leave the building unprotected where this was least expected. It all goes to show that the fire-proofing art does not always consist in having a good material, but rather in knowing how to use it when you have it. As stated in a previous article, a fire-proof material may be used either as a part of the construction where it stands by itself, as in a wall or partition; as combining with other materials to produce a complete constructive feature, such as we see in floors and roofs; or, as a protecting material attached to others that are more vulnerable to fire. Unless skillfully adapted to its use in each case it may fail. The wall or partition may be weakened by fire if the material is not of the proper shape and size, the floors may fall if heat destroys the stability of the filling or has access to the steel beams, and columns or girders may fail if heat dislodges the protecting material. It is not enough to build a wall of good fire-proof material, which is all right as long as it is cool, or a floor arch of the same, which is simply strong, or to cover columns, girders, or other exposed structural members for every-day use. Fire may destroy these conditions unless the work is equally serviceable, whether cold or hot. The several occasions on which buildings supposed to have been fire-proof have been destroyed or greatly damaged will generally be found to be illustrations of the inefficiency with which fire-proof materials have been used in their construction. But while such events are always extensively exploited, there are vastly more occasions where the fire-proof qualities of buildings have saved them from destruction and have elicited little or no notice. These occurrences seldom get into the newspapers, and if they do, are dismissed as events of little importance. The wiseacres never feel called upon to comment upon them. They lie in wait until some great building blunder is exposed, and then rush into print with their usual wholesale condemnation of all that modern science has done (of which, of course, they know but little) to reduce the dangers of fire.

It is even difficult for those who have made a study of this subject to get reliable data of incipient fires in fire-proof buildings of the best class, of which so many have been recently erected. There are at the present day, doubtless, hundreds of cases of this kind that are never reported, and of which the facts are ascertained, if at all, long after their occurrence. They are regarded as of no importance by those immediately interested. It is the purpose of this article to mention a few of which descriptions have been obtained.

On the 30th of December, 1883, a very severe fire occurred in a four-story building on Monroe St., Chicago, occupied as a paper warehouse, and it was almost totally destroyed. This building surrounded two sides of the new nine-story Montauk Block, the first of the high fire-proof office buildings erected in Chicago. The wind drew the flames against the walls of the building above the fourth story, one of which was a dead wall, but the other was full of windows without any protection from iron shutters. The building was used as a water tower by the firemen to attack the fire in the burning building. The bricks of the Montauk Block were found, after the fire was out, to be a pale gray color from the intensity of the heat,

the exposed glass was broken, and many of the window frames were burned out. In one room all the furniture and inside woodwork were burned, and the fire did not extend beyond this apartment. The floors of this building were built with 6 in. flat hollow tile arches between 6 in. I beams 4 ft. from centers. The partitions were built with 3½ in. hollow tiles and the columns and girders were protected by solid blocks of porous terra-cotta. Those on the columns were secured to the iron by screws. All the hollow tile were made of fire-clay, and it was one of the first buildings in which fire-clay had been used for making hollow tiles. All the tiles were made on a vertical sewer-pipe press in 1882. This was one of the earliest instances of the use of this powerful method of pressing hollow building tiles. The damage to the room did not extend beyond the plastering. The architects had taken the wise precaution of omittingall wood finish inside of the line of window frames and substituting plastering. The walls were not furred, consequently the burning of the window frames was less dangerous in communicating fire to the interior.

About two years after this a large apartment house was built on Euclid Avenue, Cleveland. It was eight stories high, the upper stories formed a Mansard roof, and the building stood free. All the floors were built with iron beams. The flat floor arches and partitions of six stories were built with hollow tiles made of red clay. The two upper stories were not fire-proofed. The building took fire on one of the lower floors about a year after it was built, and the fire ascended by some pipe chases, covered with wire lath and plaster, to the upper stories and roof, which were entirely consumed. The fire also descended through other chases to the lower floors and burned out several rooms. But it did not descend through any of the floor arches. Some of the ceilings and partitions in the lower stories were slightly damaged by fire, which would not have been the case had fire-clay been used.

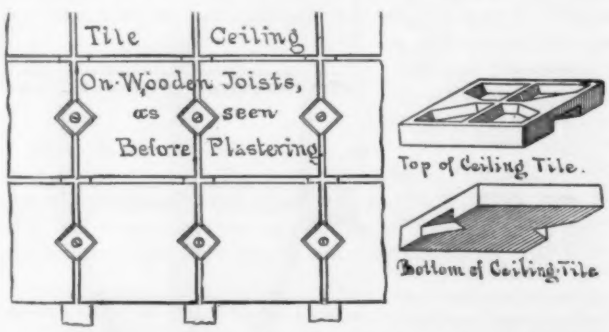
The owners rebuilt the upper stories with fire-proof material.

The Wilshire Building in the same city has been subjected to three fires, one of them of great violence. This is a large six-story and basement store and office building, having a retail clothing store on the first story and basement. The floors are all of wooden joists, 14 ins. from centers, and the ceilings are covered with 12 by 14 in. tiles of porous terra-cotta 2 ins. thick, being fastened in place with screws, having washers 2 ins. square, of $\frac{1}{16}$ in. iron, which are countersunk 1 in. into the tiles. The tiles are all hand made, and contain some fire-clay. The girders are all covered with porous terra-cotta, cast to fit their profiles, and the columns with porous terra-cotta blocks screwed to the iron. The screw-plates are all countersunk and the sinkage filled over with mortar. The first fire in this building was in a closet under a stairway, and was quickly subdued. The second fire was in an office on the fourth story, which was completely burned out. It was communicated to a room in the fifth story through the opening made for the steam and gas-pipes. The fire got behind the tiles of about one fourth of the ceiling and they dropped by the burning out of the screws. The fifth story room was damaged more than that in the fourth, but the ceiling resisted it successfully, and it did not break through where the exposed steam-pipes continued to the sixth story. This fire demonstrated the danger to be apprehended from running pipes of any kind through ceilings of tiles attached to wooden joists. But the value of the same tile ceilings was demonstrated by the third fire, which was the most severe of all. This occurred in the basement. As the first floor was level with the sidewalk, which was of prismatic lights, and similar floor lights were used in the main floor, the firemen could not get access to the basement until they had cut away the iron frames. The fire by this time had destroyed nearly all the goods and shelving in the basement. Most of the plastering fell but the tiles all remained perfect, and were newly plastered when repairs were made. There was no loss above the basement, though the fire was of considerable duration.

A six-story and basement retail store building, 115 by 170 ft. in dimension, was built by the late Martin Ryerson about the same time at the northeast corner of Wabash Avenue and Adams Street, Chicago. It was fire-proofed in the same manner as the last mentioned, and in addition the entire grand stairway, from basement to top floor, was fire-proofed on the under side and strings with porous terra-cotta, and finished with Keene's cement, the exposed treads and risers being of hard wood. The upper story, 16 ft. high, was used as a manufactory of straw hats and millinery goods, and was filled with very combustible materials, many board partitions having been put up by tenants. The building was supposed to have been struck by lightning, which set fire to the contents of this upper story in the vicinity of the head of the grand stairway, which was covered by an iron skylight. It was such a fire as would have consumed any ordinarily constructed store in a short time. The goods, boxes, shelving, and partitions of a large section of the upper story were burned, the skylight glass destroyed, and burning embers fell down the stairway well-hole before the firemen arrived. Their efforts were confined mostly to saving the goods. The ceiling of the top story was unbroken in every part. It was a suspended ceiling, and the roof was unprotected. Had it penetrated the blind attic the whole roof would have been destroyed.

When the firemen had extinguished the fire they tore down part of the tile ceiling with hooks, looking for concealed fire. But the joists showed no char. When the time came to make repairs, the contractors who had done the fire-proof work were called on for material to make good the damage done by the firemen. They returned an answer that no such material had been made for two years, because competition had resulted in its having been supplanted by a cheaper article. The contractors had to send the cheaper article. And thereby hangs a moral that need not be told.

The following illustration shows the detailed form and construction of the porous tile ceilings used in the Wilshire Building at Cleveland, and the Ryerson Building, Chicago. The tiles are 12 by 12 ins. and 12 by 14 ins., according to the spacing of the joists or



furring strips, and 2 ins. thick at the edge; but, being hollowed out on the back and recessed on the face where the countersunk washers are used, they have a uniform thickness within the rim of 1 in. with two webs crossing at the back. They were all made by hand. The screws used are No. 14, 2½ ins. long, and the washers 2 ins. square and $\frac{1}{16}$ in. thick. The same kind of tiles are used in the American Bank-Note Engraving Company's building at New York, where they are secured directly to the 3 by 14 in. joists, placed 14 ins. from centers by ⅜ in. lag bolts 3 ins. long.

(*To be continued.*)

IN connection with the article that appeared in our April number anent Expert Fire-proofing Engineers, we are glad to have our attention called to the fact that Mr. Howard Constable, of New York City, member of the American Institute of Architects and the American Society of Civil Engineers, has given much study to the subject of fire-proof construction, having had for a long time a laboratory for testing accurately the various qualities necessary in materials to be used for the protection of buildings from fire. The success that has rewarded Mr. Constable's efforts justifies the statement that the science of fire resistance is not second in importance to that of skeleton construction.

Mortar and Concrete

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING.

(Continuation of tests made by Prof. Cecil B. Smith.)

NOW there are many occasions where it would not be wise to use anything but the best Portlands — such as laying mortar in extreme frost, or where great immediate strength is required, or for subaqueous work generally; but, on the other hand, no one doubts the *durability* of good natural cement. Works in Europe hundreds of years old, and all the work done in the United States and Canada previous to thirty years ago, are built with such mortars, and stand as witnesses of their lasting qualities.

Moreover, tests made on No. 1 natural cement (see Series III., frost tests) show that while it cannot be immediately exposed to extreme cold, yet when it is exposed, after it has set, it will resist frost thoroughly, and become stronger than if immersed in water at an ordinary temperature. There are thousands of situations where natural cement mortar, 1 cement, 2 sand, will be found amply strong for the purposes required, in which case it will be found cheaper than Portland mortar, 1 cement, 3 sand. Referring ahead to Series III. (frost), it will be seen that if mortars are tested in open air, the Portlands are weaker and naturals stronger than if the briquettes had been under water. This is a point of much importance, because if work is to be done which will not usually be submerged, as in damp foundations, abutments on land, culverts, etc., then tests made in open air will give results more favorable to naturals. In so many words our standard tests say: "Let us test all hydraulic cements under water; whether the mortar as used will be so or not, we will be on the safe side." This, as a generality, is doubtless best; but if we consider what a large proportion of cement is used in situations usually not submerged, it would seem more rational to test cements under conditions similar to those under which they are to be used in each case, be it in water *or air*.

As before mentioned, all the sand tests given in the Table (Table II.) were made by tamping the mortar lightly into the molds with an iron rammer weighing about ½ lb. and ½ in. square section.

This has been done in as nearly a uniform manner as possible. About three layers were tamped, and then a fourth layer smoothed off with a spatula. Every effort was directed toward uniformity in method, and, doubtless, some degree of accuracy was obtained; but it was felt that the best possible would only enable comparisons to be made in this laboratory, it would not enable any to be made with results obtained elsewhere.

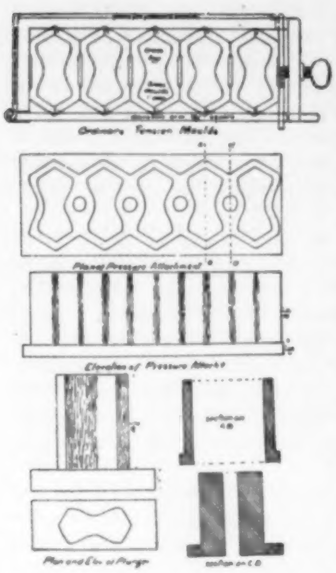
The Cement Committee of the Society (of which the writer was made a member, by invitation) advised that tests should be made under a pressure of 10 lbs. per square inch. It was not defined at the time whether this applied to sand tests only or to neat tests also; but the necessity for pressure is not so great in neat tests, because any one with ordinary skill and practise can make a good neat briquette, and a light pressure will not affect the result much, as will be shown farther on.

In November last the molds for applying pressure (see drawings), which were from a design of the writer's, modified by Mr. Withycombe, were completed, and since then several hundred briquettes

TABLE III.

Tested in tension. Pressure sand tests.

Brand.	Mixture.	Per cent. of water.	Pressure per square inch.	1 week tests, 1 air, 6 water. Lbs. per sq. in. Highest.	Lowest.	Average.	Weight when tested in ounces.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	4 week tests, 1 air, 27 water. Lbs. per sq. in. Highest.	Lowest.	Average.	Weight when tested in ounces.	Weight after two days' evaporation.	Per cent of evaporation.	Product col. 3 x col. 6.
No. 2	1 to 1	15	10	45	23	32½	4.56	3.98	12.63	410.4	71	39	59	4.64	4.01	13.49	795.9
		17½	10	165	106	136	5.26	4.84	7.98	1085.3	282	205	239½	5.32	4.95	7.03	1683.7
		20	10	130	94	117	5.56	5.08	8.62	1008.6	292	239	265½	5.52	5.17	6.34	1683.2
		22½	10	123	106	113½	5.54	4.99	9.88	1124.4	258	200	235	5.49	5.12	6.74	1583.9
No. 2	1 to 1	15	20	47	42	43½	4.79	4.05	15.52	675.1	95	70	84	4.99	4.22	15.40	1293.6
		17½	20	144	111	126½	5.37	4.92	8.38	1060.0	218	160	176½	5.27	4.83	8.35	1473.7
		20	20	157	90	114	5.07	5.13	9.63	1097.8	297	212	264	5.62	5.28	6.12	1615.6
		22½	20	126	110	119	5.54	5.03	9.28	1104.3	295	234	262	5.56	5.21	6.29	1648.0
No. 15	1 to 1	15	10	86	40	62½	4.92	4.42	10.46	653.7	113	98	104	5.04	4.41	12.50	1300.0
		17½	10	60	37	52	5.14	4.60	10.50	546.0	......	....	......	....	....	....	....
		20	10	149	108	133	5.60	5.12	8.46	1125.1	......	....	......	....	....	....	....
		22½	10	129	120	125	5.68	5.19	8.76	1095.1	......	....	......	....	....	....	....
No. 15	1 to 1	15	20	49	42	45	4.94	4.18	15.46	695.7	......	....	......	....	....	....	....
		17½	20	184	145	166½	5.62	5.28	6.61	1100.5	......	....	......	....	....	....	....
		20	20	146	114	135½	5.63	5.17	8.20	1111.1	......	....	......	....	....	....	....
		22½	20	130	108	118	5.72	5.25	8.22	970.0	......	....	......	....	....	....	....
No. 15	3 to 1	15	10	20	14	16½	4.75	4.03	15.21	251.0	35	19	28	4.61	3.88	15.88	444.6
		17½	10	12	5	7	4.59	3.92	14.66	102.6	48	32	40	4.66	4.15	11.03	441.2
		20	10	13	7	11	4.73	4.17	11.79	129.7	23	5	15	4.86	4.24	12.75	191.2
No. 15	3 to 1	15	20	23	9	16	4.64	3.97	14.48	231.7	55	28	38	4.56	4.01	12.15	461.7
		17½	20	7	2	5	....	....	....	....	40	25	33½	4.74	4.23	10.80	361.8
		20	20	17	8	12½	4.85	4.28	11.75	146.9	28	19	24	4.89	4.36	10.80	259.2
No. 9	3 to 1	15	10	25	14	19	4.37	3.81	12.77	242.6	71	58	63	4.54	3.89	14.24	897.1
		17½	10	35	18	27	4.49	4.07	9.35	252.4	106	92	96	4.72	4.24	10.17	976.3
		20	10	27	20	23½	4.68	4.08	12.91	303.4	134	101	120	4.65	4.18	10.14	1218.8
		22½	10	27	22	24½	4.85	4.23	12.86	315.1	88	74	79	4.70	4.16	11.49	907.7
		25	10	11	8	10	4.81	4.13	14.13	141.3	53	33	46½	4.73	4.11	13.18	612.9
No. 9	3 to 1	15	20	37	33	$\boxed{34}$	4.66	4.05	13.22	459.5	86	62	71½	4.69	4.15	12.23	873.7
		17½	20	33	20	27½	4.53	4.10	9.54	262.3	124	103	114½	4.75	4.27	10.15	1162.1
		20	20	29	25	26½	4.8	4.19	12.78	338.7	143	109	127	4.69	4.26	9.17	1164.5
		22½	20	25	22	23	4.86	4.27	12.06	277.4	103	87	95½	4.81	4.28	11.02	1052.4
		25	20	27	22	$\boxed{25}$	4.80	4.18	12.89	324.4	53	44	49	4.70	4.09	12.94	634.1
No. 10	3 to 1	15	10	37	30	34½	4.70	4.18	11.07	381.9	59	51	55½	4.72	4.18	12.27	681.0
		1-½	10	43	22	31½	4.67	4.12	11.69	368.2	87	63	70	4.84	4.35	10.05	703.5
		20	10	48	32	37½	4.79	4.24	11.41	427.8	65	62	63½	4.89	4.32	11.68	741.6
		22½	10	34	27	30	4.95	4.33	12.45	373.5	50	38	44½	4.88	4.22	13.48	600.0
		25	10	33	15	23½	4.92	4.27	13.14	308.7	34	23	28½	4.86	4.15	12.94	368.8
No. 10	3 to 1	15	20	41	27	33½	4.68	4.11	12.18	408.0	67	52	61	4.95	4.40	11.04	673.4
		17½	20	37	16	27	4.65	4.08	12.13	327.5	88	47	68	4.84	4.31	10.96	745.3
		20	20	42	31	35	4.82	4.24	11.96	424.5	84	56	71	4.97	4.42	11.03	783.1
		22½	20	36	23	29½	4.90	4.28	12.65	373.1	85	70	75	4.90	4.35	11.23	842.2
		25	20	33	27	31	5.00	4.35	13.06	403.0	58	34	48	4.85	4.27	11.92	572.2



have been made with them. It would seem a simple matter to mix up mortar, put it under a plunger, and by putting on 10 lbs. per square inch, make briquettes; but theory and practise must be fellow-laborers. Now, 12 per cent. of water is considered the correct thing in 3 to 1 mixtures, but with this amount, the mortar would not pack at all in a closed mold under so light a dead pressure, and it is light dead pressure that is wanted; even 20 lbs. per square inch was of no greater effect; then 15 per cent. of water was tried, with very little better results.

It was finally concluded to try several series with different percentages of water, and thereby determine the best per cent. for making a good briquette.

These series (see Table III.) ran from 15 per cent. to 25 per cent. of water, and were for 10 lbs. and 20 lbs. pressure per square inch for 1 week and 4 weeks, and each result tabulated is the average of 5 briquettes, and the whole table the result of 77 experiments, or 385 briquettes.

The result, to the author's mind, is definite; 20 per cent. of water is just sufficient to make a plastic mortar, so that a good briquette can be formed while more water tends to drown the cement, and make it weaker at both the 1 week and 4 week tests, although longer tests would probably show a recovery in this respect.

This 20 per cent. applies to 1 to 1 and 3 to 1 mixtures, and will probably be about right for 2 to 1 also, if it is desired to make such tests. It is conclusive from the table that if any standard test under light pressure is to be adopted for sand tests, 20 per cent. of water must be prescribed as a definite part of the test, and in this way perfect uniformity obtained. It is understood that the sand used is standard sand dry and sharp, a finer or rounder sand would allow less water to be used. This amount of water, while greater than that usually given by authorities whose method of making sand briquettes is by some severe hammering process (*e. q.*, German) is still close to the amount used in practise.

Even at the risk of repetition, it is worth saying again, that plastic mortar made with 20 per cent. of water is close to practise, and will give regular and accurate tests if put into molds under light pressure. The amount of this pressure does not seem to be of such great importance, but 20 lbs. per square inch gives rather sharper-edged briquettes, with about the same variation in uniformity and the same tensile strength per square inch. This is equivalent to 20 feet of masonry, which, of course, is more than practise would give; but the tests do not vary to any extent when compared with those made with 10 lbs. per square inch. Therefore, it is not deemed of sufficient importance to sacrifice good manual results. Therefore, 20 lbs. per square inch pressure and 20 per cent. water was adopted about 1 month ago, and the following results obtained (Table IV.)

(*To be continued.*)

TABLE IV.

CONDENSED SUMMARY OF PRESSURE SAND TESTS.

Put in molds with 20% water, 20 lbs. per square inch.

Brand.	Mixture.	1 week tests, 1 air, 6 water.							4 week tests, 1 air, 27 days water.							REMARKS.
		Lbs. per sq. in.			Weight when tested.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	Lbs. per sq. in.			Weight when tested.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	
		Highest.	Lowest.	Average.					Highest.	Lowest.	Average.					
No. 1	1 to 1	75	46	58	5.25	4.55	13.33	773.1	102	80	93	5.32	4.70	11.73	1090.9	Temp. of air, 60° F.
No. 2	1 to 1	157	90	114	5.67	5.13	9.63	1097.8	297	212	264	5.62	5.28	6.12	1615.6	" " 60° F.
No. 15	1 to 1	146	114	135½	5.63	5.17	8.20	1111.1	......	......	......	......	......	......	......	" " 61° F.
No. 15	3 to 1	17	8	12½	4.85	4.28	11.75	146.9	28	19	24	4.89	4.36	10.80	259.2	" " 60° F. (1) 69° F. (2)
No. 3	3 to 1	19	8	13	4.74	4.17	12.06	156.8	52	37	47	4.48	3.89	13.20	620.0	" " 63° F.
No. 9	3 to 1	29	25	26½	4.80	4.19	12.78	338.7	143	109	127	4.69	4.26	9.17	1164.5	" " 65° F. (1) 58° F. (2)
No. 10	3 to 1	42	31	35	4.82	4.24	11.96	424.5	84	56	71	4.97	4.42	11.03	783.2	" " 68° F. (1) 59° F. (2)
No. 8	3 to 1	34	25	30½	......	......	......	......	85	75	80	4.99	4.41	11.55	924.0	" " 54° F.
No. 5	3 to 1	15	12	14	4.78	4.12	13.70	191.8	58	43	50	5.13	4.36	15.01	750.0	" " 74° F.
No. 4	3 to 1	52	30	39½	4.94	4.37	11.58	457.4	118	83	103	5.02	4.49	10.56	1087.7	" " 61° F.
No. 19	3 to 1	77	58	69½	4.79	4.09	14.61	1015.3	143	101	129	4.88	......	......	......	" " 65° F.
No. 6	3 to 1	83	74	78	4.77	3.97	16.84	1313.5	139	118	128	4.90	4.28	12.65	1619.2	" " 64° F.
No. 11	3 to 1	25	15	19	4.56	4.13	9.51	180.7	46	37	41½	4.85	4.18	13.90	576.8	" " 48° F.
No. 14A	3 to 1	15	8	10½	4.69	......	......	......	36	24	30	4.88	4.16	14.76	442.8	" " 53° F.

McGILL UNIVERSITY, MONTREAL, Nov. 5, 1896.

EDITOR BRICKBUILDER.

Dear Sir: Knowing the interest that you take in cement testing, I have thought that some results obtained in our cement laboratory during the last year or two might become acceptable to some of your readers. Since our Canadian Society of Civil Engineers cement standards were fixed in 1895, the writer has carried out all tests as nearly as possible according to these standards, which includes specific gravity, residues, blowing or checking test by submergence in hot water for 24 hours, and strength tests both neat and 3 to 1 with standard crushed quartz sand. These last tests are to be carried out in a way different from that prescribed in other countries, namely, that the briquettes of 3 to 1 sand are to be formed by a dead pressure of 20 lbs. per square inch, and that the mortar is to be of a soft consistency, similar to mason's mortar, which the writer, in his series of tests in 1893–94 (which had been the basis of the society's action), had found to be 20 per cent. of water added. With a view to comparison, however, parallel tests of rammed 3 to 1 briquettes with 12 per cent. of water have been made in many cases,

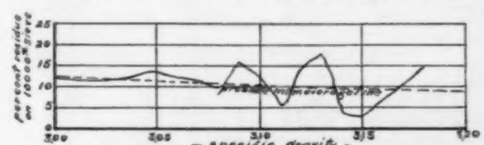


Diagram. I. Variation of Fineness with Sp Gr

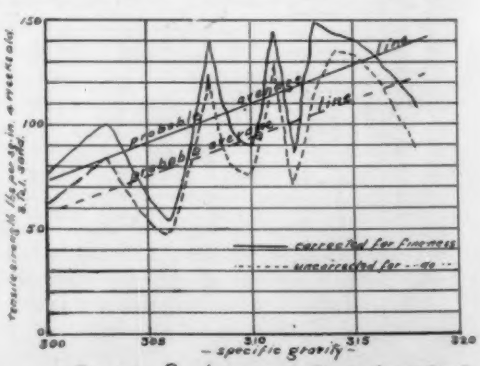


Diagram 2. Increase of Strength with Sp Gr.

and the table, here presented, contains the results of 32 tests in which this has been done. At first sight this table presents a very heterogeneous appearance, and such might be expected of cements coming from 7 different countries, of probably different chemical compositions, and of different ages, but if we plot them as diagrams in various ways many interesting facts appear. The table was arranged according to 4 week 3 to 1 pressed sand strengths.

Referring to Diagram 1, it will be seen that as the specific gravity increases, the amount of residue on a 10,000 mesh sieve remains nearly constant, if anything, decreasing. At first sight this might appear strange, but it may be easily accounted for by the fact that those manufacturers who burn their clinker well have sense enough

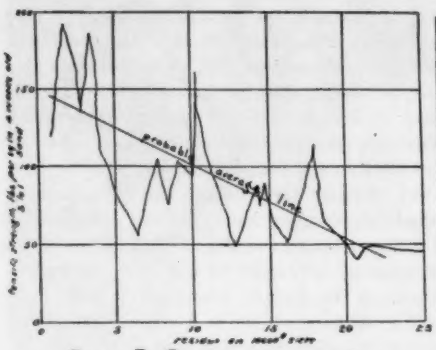


Diagram 3. Decrease of Strength with Fineness

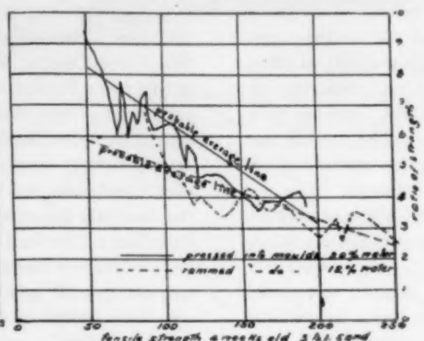


Diagram 4. Ratio of Neat to Sand Strength

Diagram 5. Ratio of Rammed to Pressed 3 to 1. - Sand Tests.

to grind well also, even though it is much harder to do than with the underburnt products. The next deduction that may be drawn from diagram 1 is that 10 per cent residue on 10,000 mesh sieve is a fair average and, therefore, easily obtainable. Any specification permitting more than 10 per cent. residue on this sieve is not up to date. The finest cement, No. 8, with $\frac{9}{10}$ per cent. residue, shows what can be obtained if sought for. The writer lays stress on this point because a recent triangular discussion in the *Engineering News* elicited conflicting opinions on this subject.

Diagram 2 also shows clearly the fallacy of a statement made in the same discussion, "that the specific gravity test was useless." In this diagram the strength of 3 to 1 sand tests increases very rapidly with the specific gravity. In order to partially eliminate the question of fineness, calculations were made (see corrected diagram line) in which a mortar made of a cement having 5 per cent. residue on 10,000 mesh sieve was considered to be a 305 to 95 mortar and an estimate made of the corresponding 3 to 1 strength; this is, of course, only a rough elimination, but it does not appreciably affect the diagram, the corrected and uncorrected lines being parallel.

The diagram also indicates that a specific gravity of less than 3.07 will seriously affect the sand tests, care being taken, however, to know the age of the cement, as an old cement (Portland) decreases in specific gravity. A range of specific gravity of 3.08 to 3.15 is wide enough to cover most good cements.

Diagram 3 illustrates the well-known effect of grinding. It would appear from this diagram that grinding is *well worth paying for* if strength is the thing required. The average of 14 cements having less than 10 per cent. residue is 121 lbs. per square inch, 3 to 1 pressed sand tests, while the average of 18 similar tests on cements having from 10 to 30 per cent. residue on same sieve is only 73 lbs., or only $\frac{3}{5}$ as much.

Coming now to Diagrams 4 and 5, an examination will show that the ratio between the neat and sand strengths decreases as the cement increases in strength; in other words, the *definition* is more rapid as to strength with sand tests than with neat tests. It is a fact that high neat tensile strength is a rough indication that the sand strength will be high also. The table shows this, but the diagram clearly points out the quicker or more sensitive fluctuation of sand tests as compared with neat. At 50 lbs. the neat strength is over 8 times as great, but at 200 lbs. the neat strength is only 3 times as great; or, while the sand strength has increased 300 per cent., the neat strength has only increased 50 per cent. Diagrams 4 and 5 also show that the tests by pressure are more sensitive than those made by ramming. This might be expected, as no extraneous effect of severe ramming interferes with the adhesive quality of the cement. With the higher grades of cement the strength at 4 weeks is nearly as great as though the briquettes were rammed, but with poor, coarse cements the strength falls very rapidly. Some time ago the writer ventured to lay before your readers an account of this method of testing sand mixtures, and until the superiority of the method is questioned, will refrain from further details.

RESULTS OF CEMENT TESTS.

Tabulated in order of strength, 3 sand, 1 cement, 20 per cent. water, 20 lbs. pressure, 4 weeks' test.

No.	Country.	Specific Gravity.	Per cent. Residue on No. 100 Sieve.	Tensile Strength. Neat 1 wk.	Tensile Strength. Neat 4 wks.	Tensile Strength. 3 to 1 1 wk.	Tensile Strength. 3 to 1 4 wks.	Tensile Strength. 3 to 1 1 wk.	Tensile Strength. 3 to 1 4 wks.
						20 per cent. water 20 lbs. pressure in molding.		12 per cent. water rammed into molds.	
1	Denmark....	3.11	1.7	596	706	71	193	137	212
2	United States.	3.08	3.5	775	790	98	187	199	224
3	Canada.......	3.04	3.8	492	656	90	170	109	160
4	Belgium......	3.08	10.3	561	631	110	165	178	258
5	Canada.	3.14	2.6	479	566	109	161	167	217
6	Germany.....	3.15	2.8	482	637	64	134	145	252
7	England......	3.09	9.2	432	551	81	122	169	216
8	Canada.......	3.12	0.9	482	625	82	121	....	....
9	Canada.......	3.13	18.0	424	653	53	115	....	....
10	Canada.......	3.14	4.0	467	558	61	114	132	204
11	Germany.....	3.07	8.0	612	682	71	106	112	175
12	Belgium......	3.03	10.1	493	582	54	94	113	187
13	Belgium......	3.09	14.8	498	602	45	90	90	171
14	Canada.......	3.18	14.3	515	658	47	88	....	....
15	Germany.....	3.10	9.2	570	655	53	87	....	....
16	Belgium......	3.07	7.1	418	573	50	83	108	164
17	Canada.......	3.11	8.2	420	495	44	83	88	122
18	Canada.......	3.08	13.7	466	549	40	80	118	178
19	France.......	3.03	13.7	385	450	44	76	86	136
20	England......	3.07	14.5	420	489	42	74	....	....
21	England......	3.12	8.5	519	665	36	74	114	155
22	Belgium......	3.08	12.0	380	422	31	70	72	116
23	England......	3.09	18.5	336	447	31	65	......	....
24	Canada.......	3.10	15.3	510	608	....	64	....	88
25	Belgium......	3.00	12.2	385	485	30	62	....	....
26	Belgium......	3.05	6.5	369	481	33	55	81	141
27	Belgium......	3.07	16.3	398	484	30	50	60	105
28	England......	3.05	21.3	286	392	25	48	....	....
29	Belgium.....	3.06	12.8	324	511	21	48	55	....
30	Canada.......	3.12	20.2	265	....	25	46	71	111
31	Canada.......	3.12	30.0	350	435	21	41	....	....
32	England......	3.09	20.7	361	397	30	39	....	....

Doubtless many of your readers will find other interesting deductions from the table and diagrams. Those which the writer has commented on have seemed to him the most obvious.

Yours respectfully,

CECIL B. SMITH.

The Masons' Department.

CONDUCTED IN THE INTERESTS OF THE MASON AND THE CONTRACTOR FOR BRICKWORK.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

EXTRAS.

NO one with experience in building matters will contradict the statement that *extras* are the cause of more trouble between clients, architects, and builders than all other questions which arise under a building contract put together. As the reasons why extras, when they are allowed to materialize, usually cause more or less embarrassment, have been considered in a previous paper, it is unnecessary to review this phase of the matter. It is important, however, to note that extras are caused in the large majority of cases by either the owner or architect, on account of omissions or changes in the plans or specifications; and when the opportunity is given the contractor to become an interested party, he usually improves it, and adds to the already existing difficulties and disagreements through insufficient allowances or excessive charges.

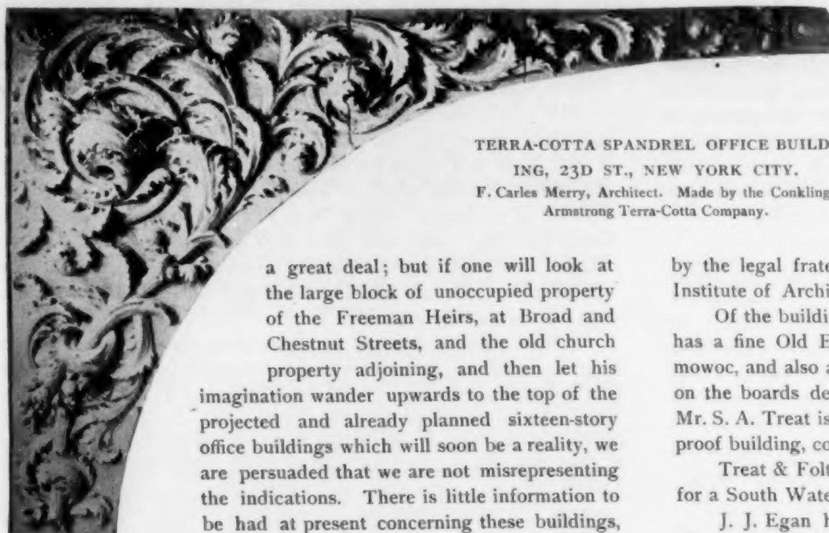
Extras in general may be divided as follows: First, what may be called legitimate ones. Second, those which are the result of oversight, inexperience, or ignorance. And third, those which are occasioned by misunderstandings among the parties concerned, which are usually between the client and architect. Every one knows, or should be made to realize before undertaking in any capacity the construction of a building of any considerable size, that such an enterprise involves the combining of so many distinct trades and interests that it is practically impossible for the architect, within the limited time which is allowed for him to draw up the plans and specifications, to provide for all possible contingencies which will develop during the progress of the work. This is in itself sufficient reason why the owner is usually called upon to pay for a certain amount of work in excess of the stipulated sum, and is a perfectly legitimate risk which an owner assumes when he undertakes to build. It is therefore plainly the duty of the architect, realizing that he is no more infallible than the rest of mankind, to acquaint his client of the fact and prepare him for the inevitable. If this precaution is taken, any reasonable man will recognize the justice of it; and so far as unreasonable clients are concerned, they are both unprofitable and undesirable. The amount of legitimate extras on ordinary work average themselves so that an experienced architect can, if he so desires, prepare his client for about the expenditure he will be called upon to make to meet these contingencies. An expenditure for such extras up to ten per cent. of the contract sum is not usually considered excessive, but this limit should not be held to include changes or additions of any importance made by the client or architect, which, of course, widely vary under different conditions and circumstances. Extras which are the result of oversight, inexperience, or ignorance, it is hardly possible to consider in detail, although they are the most aggravating which the architect is called upon to face, for there is usually no valid excuse for their existence. It is, however, important to call attention to the fact that many of the extras of this class are the result of conflicting interests; that is to say, where work of one kind interferes with another and a change is necessary to reconcile them; or, on the other hand, where two things fail to come together and extra work is required to complete the piece of labor. Trouble of this sort has been greatly increased of late by the complication of what are commonly known as "fixtures" (*i. e.*, heating, plumbing, electric work, elevators, etc.), which have developed so rapidly and have become so complicated that the architect has been hardly able to keep pace with the changes and improvements. The employment of experts on such work does not serve to simplify matters as one would expect it might, for each expert is inclined to provide for his own particular plant without considering the fact that there are other interests besides his own which must be considered. The architect who wishes to avoid extras from this cause must impress upon each expert the fact that he must confine his work within certain limits, lay out his plant so that it will not interfere with the construction or artistic requirements of the problem, and, finally and most important of all, that it is the duty of each expert to so familiarize himself with the general and special requirements of the problem at hand that he knows of his own knowledge that his particular work can be put in without conflicting with any other work, and if any conflict is found to exist or is liable to develop, he must call attention to the fact, so the matter can be considered and worked out before the work is so far advanced that the change involves additional expense. And, finally, the fact cannot be too strongly emphasized that extras of this class may be reduced to a minimum by the writing of careful and complete specifications, which is a department of architectural practise which seldom receives the attention it demands. There is a theory which is too commonly found, even among architects themselves, that while it takes a person of some little ability to design, almost any one can write specifications; but, as a matter of fact, the art of writing a complete and satisfactory specification requires a thorough knowledge of both the artistic and practical requirements of the problem, and many designs which had promised well on paper have failed in execution, because the materials and methods of execution have not been intelligently described. The fact that specification writing is often delegated to a subordinate is also responsible for extras, for it is by no means uncommon for an architect on his tour of inspection to find work actually executed of different material, and in a manner entirely at variance with the original intention, in which case, if the work is important and the architect desires to have it right, a change must be made. This involves an extra; and as the architect's commission is not sufficiently large to admit of much generosity in such directions, the owner is requested to foot the bill; but it is usually hard, when the facts become known, for him to see the justice of the claim. The architect, who wishes to avoid the embarrassments which extras of this kind are sure to bring, must, therefore, first of all, give serious attention to the writing of his specifications, and use every precaution to make them complete and accurate. "Specification reminders" are a most useful aid in preventing omissions, and if, on the completion of each piece of work, the questions which have arisen on it are noted in the office copy of the specification opposite the proper heading, the architect will in time accumulate sufficient data to enable him to reduce to the minimum the extra, resulting from omissions. Extras of the third class, those resulting from misunderstandings, are usually caused by the owners thinking certain work was included in the contract, whereas in reality such was not the intention of the architect. Such misunderstandings may seem at first thought entirely unnecessary and unexcusable, but while as a matter of fact, they are of frequent occurrence, they can be easily avoided by always making it a rule that a client shall read the specifications through and have such portions as are not clear explained to him. Some architects adopt the additional precaution of printing on the title-page of a general specification the items, if there be any, which are not included.

(*To be continued.*)

BRICKWORK constructed in cold weather, using ordinary mortar prepared with warm water, proves very unsatisfactory in point of resisting power; nor is any improvement effected by dissolving in water ½ per cent. of calcium chloride. Excellent results are obtained when the mortar is produced with warm water containing in solution 1¾ per cent. of common salt. The addition of freshly slaked lime to ordinary mortar results in a satisfactory degree of durability; but still better results are obtained by the exclusive use of freshly slaked lime, especially when employed in conjunction with calcium chloride. An admixture of Portland cement with common mortar increased its resisting power to frost.— *Thon Industrie Zeitung.*

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

PHILADELPHIA.— With the expected restoration of confidence in business circles, Philadelphia is promised some of the largest building projects which it has ever known. This is saying a great deal; but if one will look at the large block of unoccupied property of the Freeman Heirs, at Broad and Chestnut Streets, and the old church property adjoining, and then let his imagination wander upwards to the top of the projected and already planned sixteen-story office buildings which will soon be a reality, we are persuaded that we are not misrepresenting the indications. There is little information to be had at present concerning these buildings, except that they are already planned, and that the owners of the church property had in contemplation a twelve-story building, but hearing of the intention of the owners or lessees of the other part of the property to put up sixteen stories, they have determined to add four stories more, and conform their building to the other.



TERRA-COTTA SPANDREL OFFICE BUILDING, 23D ST., NEW YORK CITY.
F. Carles Merry, Architect. Made by the Conkling-Armstrong Terra-Cotta Company.

The Witherspoon Building, named in honor of Rev. John Witherspoon, a noted Presbyterian of a century ago, was the scene of a formal corner-stone laying within the month just passed; it is being built by the Presbyterian Board of Publication, and will cost $1,000,000. It will be ten stories in height, and cover an area of 230 by 75 ft., on the corner of Walnut and Juniper Streets. It is expected to be ready for occupancy about the first of August next. Architect Joseph M. Houston prepared the drawings and will superintend the construction of the work.

The same architect reports having several large projects of a similar kind in his office, which are only awaiting a revival of business to become realities.

As if to crown the list, and add still one more to the long-looked-for improvements of the city, comes the plan for the new mint, which is, we are told, soon to grace the corner of 16th and Spring Garden Steets; Architect Aiken has at last unfolded his plans and tells what the structure will be like.

It shall be the finest building, architecturally, which the Government has ever erected. The principal front will be on Spring Garden Street, and will be about 316 ft. long, the frontage on 16th and 17th Streets being 180 ft. It is built in the shape of a hollow square, thus giving plenty of light to the interior rooms. The design is classic, and the entire building is surrounded by a terrace 40 ft. wide, except the rear, which fronts directly upon Buttonwood Street. The materials shall be granite and white marble, and the interior is very conveniently and rationally laid out. It is said that the money for its erection is available, and work will be commenced in the near future.

CHICAGO.— There is a decidedly better feeling on the part of building interests since the election. How far the sentiment is justifiable remains to be seen. One evidence of the dependence of new projects on the outcome of the political situation is a million-dollar building, the plans for which were being rushed by Jenney & Mundie before election. Bids and options were to be obtained on pre-election prices of steel, etc., to forestall the stiffening of prices anticipated in the event of McKinley's election. Had Bryan been elected, the whole enterprise would have lain still indefinitely. The building referred to is The Fair, which was planned several years ago for sixteen stories in height, and to cover an area 190 by 350 ft., fronting on State, Adams, and Dearborn Streets. Half of this was built eight stories high, and now the other half will go up to complete a fine block, impressive in size, even without the upper eight stories. The entire exterior is to be brick and terra-cotta.

The proposition to put three additional stories on the old court house was encouraged by the legal fraternity, but the people voted on the advice of the Institute of Architects and the Real Estate Board, and vetoed it.

Of the buildings to be erected in the near future, Howard Shaw has a fine Old English half timber and brick residence at Oconomowoc, and also a golf club house at the same place. Mr. Shaw has on the boards designs for a new manufacturing building, for which Mr. S. A. Treat is associate architect. This will be a seven-story fire-proof building, costing about $100,000.

Treat & Foltz have on hand a new terra-cotta and brick front for a South Water Street warehouse.

J. J. Egan has designed a "Home for the Aged." The estimated cost is given as $65,000.

Jenney & Mundie have designed a $50,000 apartment building, which is to have an exterior of buff brick and white terra-cotta, and fire-proof interior construction. The same architects have several residences on the boards.

ST. LOUIS.— Between carnivals, national conventions in bunches, and the excitement of the political campaign, we have had little time to worry about business inactivity.

Turning from this transient excitement, we are glad to be once again greeted by the hum and throb of legitimate business activity, for, as a direct result of the election, signs of returning prosperity are everywhere manifesting themselves.

TERRA-COTTA PANEL, BURNHAM ATHENÆUM, CHAMPAIGN, ILL.
Made by Perth Amboy Terra-Cotta Company.

It is generally expected that much of the work that had been started, also work in all stages of development on the boards which was discontinued awaiting the result of the election, will now go ahead, although the lateness of the season may be a retarding factor.

R. W. Morrison has completed the large commercial building on

Washington Avenue for the Tindell Estate. It is seven stories, — two of red granite, five of gray brick and terra-cotta; slow-burning construction.

MADE BY THE NEW JERSEY TERRA-COTTA COMPANY, FOR Y. M. C. A. BUILDING, NEW YORK CITY.
James E. Ware, Architect.

A new seven-story building on Fourth Street, for the Collier Estate, — Shepley, Rutan & Coolidge, architects, — is interesting because of the grouping of the windows, those in the center having a heavy terra-cotta band around them which extends up through the several stories. A tier of smaller windows is on each end and across the seventh story. Gray brick and terra-cotta were employed.

PITTSBURG. — The advent of the office building in this city has created a tenancy never before known. Twelve or fifteen years ago such a thing as an office building here was unknown. To-day there are over fifty first-class office buildings, counting only those which have passenger elevator service, and otherwise fully equipped with the better and later improvements for comfort of the tenants. Nearly eighty per cent. of the offices in these buildings are always rented and bring the percentage counted on by the owners. Those office buildings that fail to reach that limit are either improperly managed or are situated in poor localities.

Geo. Orth & Bros. and Peabody & Stearns are the architects who are in competition for plans of a bank building for the National Bank of Western Pennsylvania, which will be erected here.

Architects E. J. Carlisle & Co. will soon prepare plans for an eight-room brick schoolhouse for the Eighteenth Ward, to cost $25,000.

Pitcairn Borough will build a new brick and stone schoolhouse, to cost about $20,000.

It is reported that Architect Miss Elise Mercur has the plans for the clubhouse of the Twentieth Century Club, to be erected here at a cost of $75,000.

Architect F. C. Sauer is to prepare plans for a brick and stone church for St. Joseph's Roman Catholic congregation in Allegheny, to cost about $50,000.

Architect Chas. Bickel has submitted plans for the German Evangelical Lutheran Church on Mt. Washington. It will be of brick, and cost about $75,000.

The plans of Architect T. P. Chandler, Jr., of Philadelphia, Penn., have been adopted for the new edifice of the Third Presbyterian Church, to be erected in the East End, at a cost of $200,000.

Architects Alden & Harlow have prepared plans for a Lutheran Church, to be erected at Vandergrift, to cost about $15,000.

Dr. J. B. Herron has donated a very valuable piece of property on Sandusky Street, Allegheny, for the new United Presbyterian Hospital. Plans have been asked for from architects. It is expected to cost $75,000.

Architect W. H. Sims has completed plans for a $20,000 residence for Geo. Baum, on North Negley Avenue.

MINNEAPOLIS. — Up to November 3, building matters were the quietest since last January. The very next day, when McKinley's election seemed certain, there was an immediate move towards carrying out some of the numerous projects which were held in abeyance pending result of elections. The assurance of the result has reassured capitalists and property owners. Gold came out of hiding-places and was offered for deposit at all the banks.

Of course we cannot hope for a very large revival in our business before spring, then there is no doubt whatever of the result. We are going to have the best year in the Northwest in past ten years. So much work for a year or two past has "hung fire" that its immediate carrying out is enough of itself to warrant this assertion, and we know that there will be a great deal of new work, that is as yet in embryo.

We voted on propositions to issue school bonds for $200,000. This was carried by overwhelming majority, and insures the erection of four or five new school buildings here next year, which are badly needed, notwithstanding the fact that three were erected this year, and same number previous year.

T. B. Walker began the erection of a $30,000 business building the second morning after the election, a building 85 by 125 ft. A number of residences costing from $2,500 to $10,000 are now assured this year, which were held back pending result of election. There is every inducement for a man who has the means to avail himself of the present low prices of labor and materials of every kind, and this fact is fully realized.

There is plenty of money available now, whereas a week ago it was impossible to get any sort of an accommodation, and gold could not be had on any terms. The day following election the banks paid it out without reserve. The croakings of would-be repudiationists is silenced at the very outset by the easy and confident feeling which prevails generally, and only three days after election. Instead of reducing force and production, the very reverse is the order now, and there is a strong liability of shortage in labor and materials when spring arrives, owing to the sudden and heavy demand that will be made in all lines.

At the regular monthly meeting of the Minnesota Chapter, A. I. A., held on evening of November 6, at West Hotel, a paper was read by E. P. Overmire on the "Inception of Modern Steel Construction," followed by a general discussion of the subject. The writer of this paper contends, after investigation, that the credit for having first devised this system of construction belongs to L. S. Buffington, Architect, of Minneapolis, he having patented his invention in 1887, at which time his claims and the twenty-eight-story

CAPITAL FOR GARFIELD PARK BAND STAND, CHICAGO.
J. L. Silsbee, Architect. Made by Northwestern Terra-Cotta Company.

building he designed were published and excited ridicule all over the country, architectural periodicals, as well as daily newspapers, joining in the chorus. A number present expressed themselves as of the same opinion as the author of the paper, and also thought that justice should be done the inventor.

TRADE PUBLICATIONS.

THE Philadelphia & Boston Face Brick Company has just issued a revised catalog of molded and ornamental brick. We are confident that architects and builders will appreciate the effort to create a sufficiently extensive variety of carefully modeled forms to carry out the most ornate work of Renaissance architecture in brickwork. The shapes are admirably chosen and seem to provide for almost every probable combination which would be encountered in ordinary commercial structures, while in addition there are a number of special patterns which can be adapted to decorative effects in combination with fireplaces and elaborations of detail on quite an extensive scale. The possibilities of molded brick have been fully appreciated by some of our architects, who have been able to obtain very satisfactory results at a minimum expenditure, and the Philadelphia & Boston Company has studied so carefully what might be called the standard requirements that the forms have a familiar, copiable aspect which make them seem like one's own thoughts. The company is to be congratulated upon the improvements made in its processes and designs.

TRADE DIRECTORIES FOR 1896–97.

THE ARCHITECTS' DIRECTORY, containing a list of the architects in the United States and Canada, classified by States and towns, with the architectural associations to which they belong indicated against each name. Prepared with the greatest care to secure accuracy both in names and location. Together with a classified index of prominent dealers and manufacturers of building materials and appliances. Price, $1.00. William T. Comstock, 23 Warren Street, New York.

HENDRICKS' ARCHITECTS' AND BUILDERS' GUIDE AND CONTRACTORS' DIRECTORY OF AMERICA, for builders, contractors, manufacturers, and dealers in all kinds of building supplies. A complete directory of all the construction industries of the country, containing over 170,000 names, addresses, and business classifications, comprising builders and contractors of material and construction in the building and kindred industries. With full lists of the manufacturers of and dealers in everything employed in the manufacture of material and apparatus used in these industries — from the raw material to the manufactured article, and from the producer to the consumer. Price, $5.00. Published by Samuel E. Hendricks Company, 61 Beekman Street, New York.

BUILDING AND ENGINEERING TRADES DIRECTORY, containing complete and accurate lists, properly classified and indexed, of contractors and builders, also of manufacturers and dealers in all materials, apparatus, and appliances used in the construction, furnishing, and equipment of modern buildings and engineering projects, and all others identified with these interests in Boston and vicinity. Supplemented by the official lists of the building exchanges of Boston, together with the architects and engineers of New England. Price, $2.00. F. W. Dodge, publisher, Boston, Mass.

CHANGE OF FIRM NAME.

THE TIFFANY PRESSED BRICK COMPANY, Chicago, who are extensive manufacturers of a high-grade enameled brick, have changed the style of their firm name to the Tiffany Enameled Brick Company.

Mr. James L. Rankine, formerly president of the Pennsylvania Enameled Brick Company, having severed his connection with that firm, will manage the interests of the Tiffany Company in the East. Mr. Rankine's headquarters will be at Room 626 156 Fifth Avenue, New York City.

AFTER ELECTION NEWS.

MEEKER & CARTER have secured the contract for the terra-cotta in the new hall at Vassar College, York & Sawyer, architects; D. C. Weeks, builder. The color is light gray.

THE schoolhouse to be built in Roxbury district, Boston, will be built of Gartcraig Scotch bricks, those furnished by Waldo Bros. for other city buildings having been so satisfactory.

MEEKER & CARTER have the contract for the bricks to be used in the St. Francis de Sales Church, Brooklyn, R. L. Daus, architect; John T. Woodruff, builder. The bricks will be of an old gold shade and about 500,000 will be used.

THE TIFFANY ENAMELED BRICK COMPANY will furnish their enameled brick in the following new buildings. The Zoological Building, Pittsburg, Penn., J. L. Silsbee, architect. Women's Gymnasium, Ann Arbor, Mich. (Michigan University), Jno. Scott & Co., architects. Onondaga County Savings Bank Building, Syracuse, N. Y., R. W. Gibson, architect. City morgue, Cleveland, O.

THE PERTH AMBOY TERRA-COTTA COMPANY has closed the following new contracts for architectural terra-cotta. Park Row Building, Nos. 13–21 Park Row, New York City, R. H. Robertson, architect. York Hall for Omicron Association, New Haven, Conn., Grotvenor Atterbury, architect.

O. W. PETERSON & CO., Hancock Building, Boston, New England agents for the Standard Terra-Cotta Company, have secured the terra-cotta contract for the Taylor Building, Worcester, Mass., Fuller & Delano, architects; Thos. Barrett, contractor. Building is of light brick and terra-cotta.

THE NEW YORK AND NEW JERSEY FIRE-PROOFING COMPANY shipped last month about 4,200 tons of fire-proofing, and has booked a number of very large orders, which will keep them busy for some months. The demand for first-class fire-proofing material made of burned clay is greatly on the increase, and as the election is now settled, there is every prospect that business will continue to improve. A large number of new schools are to be erected in New York, provided the new issue of bonds to be sold by the city are successfully floated. Fire-proof structures can now be erected so cheaply that the number of them is greatly increasing.

CHAMBERS BROS. COMPANY, Philadelphia, are supplying a new outfit of machinery for rebuilding the works of the McAvoy Vitrified Brick Company, located near Philadelphia, and recently destroyed by fire. The new machine house, as well as the drying tunnels, will be built entirely of brick, with metal roof. The grinding machinery will be in a room partitioned off from the main machinery building. In equipping this new plant they will double their former grinding capacity, and put in a machine capable of making from 60,000 to 70,000 paving brick per day. They are also making some additions to their kiln capacity. The work is being pushed as rapidly as possible, as they have some important contracts on hand.

THE AMERICAN ENAMELED BRICK AND TILE COMPANY, New York, has recently completed a most satisfactory job at the new building for the Old Men's Home at Brooklyn, Johnson & Company, architects. In this building their patented interlocking tile was used to the exclusion of the full-sized enameled brick. These tiles will be used for wainscoting in the new building for the fire department at Jersey City. The same company will supply their enameled bricks for the new building of the Title Guaranty & Trust Company at Brooklyn, H. Anthony, architect, also for the completion of some work on the estate of Mr. Vanderbilt at Hyde Park on the Hudson, Norcross Brothers, builders.

The second quality enameled brick made by this company find a ready sale because of their general excellence. Fifty thousand of these bricks will be used in the St. John's Home Building at Brooklyn. The city of New York has used many of these bricks for lining cesspools and sewers.

Mount Savage Enameled Brick Company.

MOUNT SAVAGE, MD., is a small town nestling in a picturesque valley at the foot of Savage Mountain, one of the Alleghanies. The recollections of the oldest of its two thousand inhabitants are of historical interest, as it was here that the first solid railroad rail was rolled in the United States. The old rolling mill has disappeared long ago, but the ruins of the blast furnaces are still to the fore, a relic of bygone days.

Passing through the town is the Cumberland and Pennsylvania Railroad, which connects with the Baltimore and Ohio and the Pennsylvania Railroads at Cumberland, seven miles distant. This railroad runs through the coal fields of this well-known region.

The chief industry of Mount Savage is the manufacture of all descriptions of refractory goods from the fire-clay confined to this section of the country. This celebrated clay is justly recognized as one of the leading fire-clays of the world, and was discovered in the year 1840, fire-brick being manufactured the following year.

From the small beginning then made the business has increased year by year, until now the works cover fifteen acres of ground with a yearly capacity of 20,000,000 fire-bricks alone.

So well known are these bricks for their property of resisting high and continued heat, that they are shipped south to Mexico, north to Nova Scotia and Canada, and west to San Francisco and Montana.

MOUNT SAVAGE BRICK WORKS, MOUNT SAVAGE, MD.

The clay used is dark gray in color, having the appearance to the uninitiated of a hard rock; hard it is, but on the exposure of it to the action of the weather for a few months, it crumbles to a powder, which, on the mixture of water in the mixing pans, becomes exceedingly plastic.

In all chemical and empirical tests made by the government, it is passed as the highest grade, and is declared standard, all other clays being judged according to the relation they bear to it.

The superiority of this clay has long been acknowledged by those engaged in the trade, having enjoyed for half a century the highest reputation, and drawing to Mount Savage all our leading geologists, and others interested in the formation.

As the works have been going continually for the past fifty-five years, the men presently employed have stepped into the places previously occupied by their fathers, and, as it were, been born to it, are most expert in their different occupations, thus insuring excellence and uniformity in the product.

But Mount Savage is yet to achieve further honors in the manipulation of her clay, as a new branch has been added, the manufacture of enameled brick.

How this came about was through the pluck and perseverance of a young Scotchman, Mr. A. Ramsay, who landed in New York in January, 1895. Having been engaged in exporting these and similar goods to this side, and aware of the growing demand, he came to the conclusion that, from what he had read and heard of the resources of the United States, enameled brick could be manufactured here of equal quality to the English and Scotch makes.

Shortly after landing he settled down in Trenton, N. J., and there passed several months testing and experimenting with the clays of New Jersey, but with poor results; he next tried the clays of Pennsylvania and Ohio, but these were equally discouraging. The New Jersey and Ohio clays are altogether different from that used in England for making enameled brick, as the clay is there found along with the coal measures, sometimes as deep down in the ground as 100 to 150 fathoms. The clay from the Pennsylvania coal fields, which Mr. Ramsay tested, was of inferior quality also, being deficient in fire-resisting qualities, and having excessive shrinkage, which is detrimental to high-class work.

He next turned his attention to the clay of Mount Savage, and saw at once he had found what he was looking for. In a short time he removed to Mount Savage to make further experiments, building a trial kiln in which to burn the ware. The first kiln turned out proved that his judgment was correct, and with the second he had a brick which compared favorably with the best.

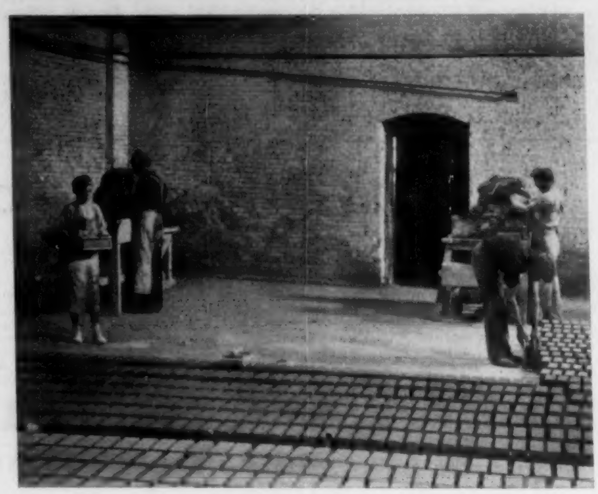
With these results he had no trouble in interesting such capitalists as Warren Delano, Jr., of New York City, president of the Mill Creek Coal Company, Bee-Hive Coke Oven By-Products Company, director Union Mining Company, and also connected with other varied interests in the States of New Jersey, Pennsylvania, and Maryland; the Hon. John Sheridan, of Black, Sheridan & Wilson Coal Company, president of the New York Mining Company, a director Union Mining Company, Potomac Coal Company, Barton & Georges Creek Coal Company, government director of the Union Pacific Railroad Company, and one of our foremost mining men; Hugh A. McMullen, a well-known young business man of Cumberland, who, eminently successful in his own business, at once saw the importance of this new branch, and entered into it with his customary zeal. James Findlay, who succeeded his father as manager of the Mount Savage clay mines, and who has been engaged all his life mining and shipping the clay, also joined in, with the result that, in November, 1895, the Mount Savage Enameled Brick Company was formed

ENAMELED BRICK PLANT AT MOUNT SAVAGE.

with a capital stock of $75,000, fully subscribed. Warren Delano, Jr., president, Hon. John Sheridan, vice-president, Hugh A. McMullen, treasurer, Andrew Ramsay, general manager, these with James Findlay forming the board of directors.

It was decided to build a new plant, but owing to the approach of winter very little could be done. A start, however, was made, but when the frost set in a halt was called until the spring.

During this interval, Mr. Ramsay left for Scotland, having previously shipped a large consignment of Mount Savage clay over to the Coltness Iron Company, of whose fire-clay works he was formerly manager. Here he had the clay put through the usual process, with the result that his previous successes were confirmed, the bricks made being equal in every respect to the best, and superior to most found in England and Scotland.



HAND MOLDING AT MOUNT SAVAGE.

On his return in the spring work was resumed on the new building, and by the end of July last the plant was finished.

This plant is altogether a model one, being a substantial structure of brick with slate roofs. It has all the latest improvements in machinery, kilns, and other appliances.

The present capacity is thirty thousand bricks per week, but with a view to further extension, the machinery put in is capable of turning out one hundred thousand per week, which output could be quickly reached by adding more kilns.

The system of manufacture is the same as carried on by the leading English makers. The bricks are all hand made, by what is called the dry-stock method. This is entirely different from the system carried on by all or nearly all of our domestic manufacturers, who use the wire-cut or dry-press brick machines, which, while lowering the cost, does not improve the quality.

In making by hand, the clay is tempered very soft in the grinding pans, consequently every particle of clay is perfectly bonded, thus insuring a brick hard and dense, and, when properly burned, absorbing but little moisture.

The bricks, on leaving the hand molder, are placed on a hot floor, where they lie until stiff enough to handle. When so they are taken up, and pressed into shape by a steam press, and again through a hand press. By giving them this extra pressure, the bricks are made perfectly true and square.

They are now dipped in the enamel, and when dry placed in the kilns, where they are finished in one burning.

The clay being most refractory, and comparatively free from iron and other injurious matter, it can with safety be subjected to intense heat, thus thoroughly incorporating the enamel with the body of the brick, the enamel being fused in such a manner that all the frost in the next century will not detach it, and which the Mount Savage Enameled Brick Company guarantee not to scale, craze, or change color.

This company has not yet appointed agents, but are open for applications from leading firms of good standing.